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# Electrical World

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# Electrical World

*The consolidation of* ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

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## An Agency for Publicity

IN AN important campaign of publicity advantage should be taken of every useful existing agency. Skill and experience are just as essential in the preparation of publicity matter as engineering advice is in power-house work. Without either the results may be disastrous. The electrical industry has an organization formed for the express purpose of acquainting the public with the advantages and uses of electricity; namely, the Society for Electrical Development. This organization has done some excellent work and if properly supported by the central-station industry can undertake a publicity campaign which will have a telling effect. Thus one phase of the needed publicity for the National Electric Light Association can be solved by an agency already in existence. However, no great results are possible without adequate financial support. The electric power and lighting industry, therefore, cannot shift the burden entirely. There is a great deal of work which it must do for itself and which it can easily undertake. All that is necessary for an organization like the National Electric Light Association to possess is a still more inspiring and effectual zeal to promote the work of the industry in every community and a widespread diffusion of its confidence that electricity offers a solution for many of the present industrial and domestic problems. While all the imperfections of government ownership and operation are fresh in the minds of the public, the merits inherent in private ownership and operation can be presented to advantage.

*More intense application of electricity can be brought about through education. It is surprising what excellent results can be obtained thereby and how many evils succumb to its influence, but educational movements must be rational to be successful, and all that is fictitious and non-essential must be eliminated. The convenience of electricity is not capitalized enough.*

## Synchronous-Motor Characteristics

THE synchronous motor in running operation may have its electrical performances represented graphically on a straight-line chart, on a circular chart or on a V-chart, according to the purpose of the diagram, as was pointed out originally by Blondel. It is not so generally known, however, that during the starting or non-uniform running operation a synchronous motor behaves in such a manner as to conform to a Heyland circle diagram, like an ordinary induction motor.

In the article by Theo. Schou, the second part of which we print this week, the circle diagram is applied with considerable advantage to the starting régime of a synchronous motor. The comparative effects of brass and copper squirrel-cage bars are discussed in relation to this diagram. The synchronous-motor circle diagram bears many resemblances to the induction-motor circular diagram; but there are also various differences in detail between them. The article by Mr. Schou is well worth the study of those interested in this subject.

*Managers of electric utilities should appreciate that expediency will never suffice to solve problems which by their nature call for the application of something more fundamental. It is useless to talk of mere policy if what is actually involved is principle.*

## Standardizing Park and Boulevard Lighting

THE lighting of parks and boulevards is a branch of the street-lighting art which stands rather by itself. To a certain extent the requirements are alike in both parks and boulevards. The locations in parks are, of course, somewhat arbitrarily determined by the topography, while on the boulevards the units must be placed somewhat as in ordinary street lighting, but with the requirements of a moderate and well-distributed light rather than the high intensities necessary in first-class streets or the much lower requirements of average residence districts. A paper by F. H. Murphy elsewhere in our columns this week gives a very instructive report on the way in which the joint problem of parks and boulevards was solved in Portland, Ore.

After several experiments the park superintendent, under skilled advice, settled on a uniform system of 400-cp. series tungsten lamps operated at 6.6 amp. from constant-current transformers. These, with the appropriate switchboards, were housed in suitable combination buildings planned to be as harmonious as possible with respect to their surroundings. The available circuit is 2300-volt, 60-cycle primary, and the transformers, for one or two circuits as the case may be, are installed after a uniform plan with standard switchboard units. The distribution at constant current is through lead-covered, varnished-cambric cable, the lead sheath being served with tarred jute, armored and again wrapped with jute filled with preservative. For the installation of the lights themselves a single-lamp reinforced-concrete standard approximately 12 ft. high was selected, and upon this the lamp is mounted in an Alba globe. Particular precautions, described in detail, are taken to secure safe and well-insulated lamp connections. Somewhat more than 200 units of this character have already been installed, and as the park and boulevard system grows it is necessary only to duplicate existing equipment in order to reach a thoroughly satisfactory result.

## Emergency Repairs

WE GIVE a detailed description this week of a rather notable feat in generator repairing performed by the Union Electric Light & Power Company of St. Louis. The field of a 12,000-kva. turbo-generator went bad. Tests showed that it was grounded and that the coils were damaged. The insulation proved to be in poor shape. The original insulation was fiber paper and oiled linen, and this was found to be subject to carbonization at an unpleasantly low temperature, so that when it was decided to replace the insulation it was done with horn fiber, mica, and mica and asbestos tape. The job was done by expert workmen from the factory, bringing with them the necessary kit of tools; then on the spot a repair shop was extemporized with all necessary provisions for treating, replacing and reinsulating the coils. Each separate coil was heated by a current heavy enough to soften the old varnish and tape, was stripped down, soaked out in caustic soda until all the old insulation was clear, washed, dried and repaired when necessary by oxyacetylene welds. Then the slow job of reinsulating began, and one after another of the coils was finished, dried and put into place in the reinsulated slots. The whole job never required more than ten men at any one time, and at various periods it required carpenters, ironworkers, machinists, blacksmiths, electricians, armature winders, laborers and drivers. So efficiently did they put in their time that the machine was actually out of service just 731 hours and 17 minutes, which, considering the amount of work necessary to be done, may be reckoned as record time.

*It may be noticed that the Commercial Section proposes to step on the accelerator at the National Electric Light Association convention at Atlantic City. Its members want everybody to know that they have something to sell. This is the first move toward making the actual sale.*

## Revealing Transformer Overloads and Underloads

THE limiting output of a transformer on a distributing system is either its regulation or its temperature elevation. That is, a load on the transformer becomes excessive either when the voltage drop at secondary mains becomes excessive or when the transformer coils become too hot. In practice it is usually the heat limitation which controls. The tendency in many systems is for the load on distributing transformers to increase as time goes on. As originally installed, a transformer for a group of houses may be amply large enough when the installations are new. As the years go by more fans, lamps, heaters, irons, toasters and other domestic conveniences find their way on to the house mains, to say nothing of occasional new house services being added to the secondary mains. The transformer may thus gradually become overloaded and run hot.

Frank A. Robbins, in an article in this issue, points out that a self-registering maximum thermometer may conveniently be placed in an oil duct between the windings of a transformer, so as to record automatically the maximum temperature elevation attained in the oil. It might even be worth while to install such a thermometer permanently in particular types of transformers, so as to allow the maximum registration to be read at any time on the outside, and with facilities provided for the inspector to reset the register externally on any visit. A glance at the register would show at once whether the transformer had been thermally loaded nearly to the limit.

As is pointed out in the article, it is nearly as bad to have transformers much underloaded as to have them in occasional danger of overload. Good engineering aims at operating materials continuously at proper loads, with safeguards against either idleness or excess. The maximum temperature record is again a suitable indication as to underloading.

It is interesting to note that as a matter of general average experience "the demand of one consumer is equal to a little more than one flatiron." This is an easily remembered rule. The flatiron has many and undeniable advantages in the home, but its adaptability as a unit of demand has remained unsuspected hitherto.

*The Postmaster-General's little journey into the Elysian fields of government operation of everything is now being fully revealed as an abject failure. It started the advocates of states' rights, it made employees disgruntled, the public dissatisfied. Who does it reverence now?*

## Serving Small Communities

ONE of the problems of long-distance transmission is the difficulty of serving local communities along the line from the high-tension main transmission. We give this week some account of the manner in which this difficulty has been faced in the vicinity of St. Louis. The territory to be covered in the long run would reach something like 5000 square miles (13,000 sq.km.), and it was necessary to develop a feasible distribution system to be fed from lines of any available tension and permitting economical delivery of power over considerable distances. To this end a standard type of outdoor station has been developed, planned for operation at 26,400 volts primary and 2300-4000 four-wire secondary for the actual distribution. The primary voltage is high enough to meet the practical requirements of the case. The large units could be fed, if necessary, from any available voltage, and the four-wire distribution gives a long and efficient radius for serving the communities concerned.

The outdoor substations, of which eight have been already installed, are built up from a framework of six expanded steel poles inclosing a space 12 ft. by 42 ft. and 25 ft. high (3.6 m. by 12.7 m. by 7.6 m.). Each station has four three-pole air-break switches for the high voltage, two for each of the duplicate transmission lines feeding the stations. There are also switches for tying the lines together, choke coils and fuses. The smallest size of transformer used in these substations is of 100-kva. rating, with units up to 1000 kva. when necessary. The lighting service from each substation is supplied through an automatic induction regulator—in some of the smaller stations out of doors, in cases where the load is considerably heavier housed in an adequate inclosure adjacent to the substation proper. The metering is all done on the low-tension side of the transformers, which simplifies the situation considerably, as all the losses of transmission and transformation are taken care of by the transmission company. By adopting this simple and systematic arrangement of substations it has been possible to keep down costs

to a very gratifying degree. For example, even at the 1917 prices a substation for the minimum capacity of 500 kva. was erected ready for service, including transformers, at a total cost, including all items, of just about an even $20 per kva., while the larger stations in which the only substantial increase of cost is an added transformer capacity dropped to little more than half this figure—all of which goes to show that a properly designed standard outdoor substation solves the difficulty of cheap distribution in a very satisfactory manner.

*It can be only a question of time when the serious deficiency in housing accommodations in many localities will force active building in this direction. If we are not ready for the demand for materials and energy which this will mean, now is the time to take that far-sighted look ahead.*

## Conservation of Human Energy

IN THE long run the utilization of water power means the saving of human energy for purposes to which power-driven machinery is not yet adapted. The discussion of conservation with reference to its effect on human industry by Dr. George O. Smith at Springfield, Mass., the other day brings impressively to our consideration the real importance of economizing natural resources, and above all of economizing labor. The mere change from steam power to water power is not only significant of lowered costs in manufacturing and of the saving of the earth's stored fuel for its most important use, but it relieves the labor necessary in mining the coal and the still greater burden of transporting it. The miner's output is something less than 1000 tons a year, so that for every 1000 tons diminution of the fuel requirement the equivalent of one man is set free for other activities. Every water power harnessed and displacing steam power implies, therefore, a great band of laborers in the mine and on the railroads freed from this particular necessity of toil for other and more useful labor. Now, at the end of the world war, the time has come when we must look sharply to conservation in every line. The price of labor has risen beyond the wildest dreams of the wildest socialists of the last generation, and the labor cost in all manufactured articles almost staggers belief.

If we are to come in this country to a condition of production that shall give us the remotest chance of successful competition in the world's market, it must be through the most determined efforts at cheap power production and all possible saving in the field of human labor. The great power enterprises of the present day give opportunity such as has not yet been realized. Whether the plan for super-power stations and the linkage of hydraulic output all along the Atlantic seaboard are carried out or not, we are still certain to demand much of power transmission in the very near future. England has undertaken a carefully developed scheme for the general economical distribution of power, and in virtue of it will infallibly be put into a position to command the world's markets unless similar efforts are made elsewhere. Where the power is, there will manufactures be gathered. Only the other day we noted in an English journal an advertisement of cheap hydroelectric power to be had in quantity just south of the Pyrenees on the Spanish border. Such an advertisement tells a story that we must heed of the vital importance of cheap power to success in the world's market, and of the danger of wasting time in futile debate over the development of the great powers on the public domain, now unused, lest some man of vision and enterprise should win a decent return for bringing them to his country's markets.

*In the uncertain and sometimes conflicting currents which make up to-day the sum total of what we call "business," there is room and need for the stabilizing voice of the electrical industry in each city. It is essentially an optimist industry, a great upbuilder, yet sensitive to real conditions.*

## Returned to the Owners

DURING the early stages of government operation of the systems of wire lines the federal authorities were not, at least outwardly, over-sensitive to public dissatisfaction or to uneasiness on the part of investors whose property they were experimenting with. They had decreed; they were satisfied; they would go from war-time operation to peace-time operation. Was it the affair of any one but themselves? Even when the storm of unrest began to gather and the clouds to lower, there was little modification in the complacent attitude of official Washington.

It may not be rash to assume that a change began to develop in the viewpoint of official Washington as to the expediency of its persistence about the time the state commissions acted on telephone rates. Here was a clear questioning of the official federal contention. It could be fought in the courts, but it could not be easily explained away. It could not be truthfully described as politics. It was not partisan; it showed in all sections of the country a desire for state regulation of rates. It showed a conviction that the policy of private ownership subject to state regulation was not obsolescent.

This aroused opinion, as voiced by the state commissions, was followed by other signs. There was the strike in New England, and the public developed a strange opposition to the quality of service and the steady deterioration in the value of the telegraph and telephone adjuncts to commercial and domestic convenience.

Last week the state commissioners met in Chicago to complete their plans for carrying their case on telephone rates to the highest tribunal in the land. Quickly the announcement of their deliberations was followed from Washington by the statement that the cable systems would be returned to their owners forthwith. The wondering citizen sees then that the telephone lines are to be given back to their owners just so soon as Congress shall pass legislation which the Postmaster-General believes is necessary. Whether these developments foreshadow also the early return of the railroads to their owners is a subject on which individuals may guess to suit themselves.

It is a cause for congratulation that the properties whose operation was acquired by the government under stress of war are, in part at least, to be returned to those who own them and that the entirely anomalous situation whereby control was retained in peace time under authority of a purely war measure is, at any rate in partial degree, to be corrected. What Congress sought was the defence of the nation, not experiments in government operation.

# Synchronous Motor Characteristics—II

## A Compound Squirrel-Cage Winding Has Been Developed with Which Synchronous Motors Will Pull Into Step, Carrying Full Load at Reasonable Kva. Intake—This Characteristic Should Increase the Usefulness of Synchronous Motors

BY THEO. SCHOU
Consulting Electrical Engineer Electric Machinery Company

THE starting torque of synchronous motors with squirrel-cage windings, as derived by a circle diagram, was discussed in the first article of this series. In addition to good starting torque, synchronous motors used for general power purposes should be capable of pulling into step even under considerable load. Unfortunately, however, high starting torque cannot be obtained without sacrificing pull-in torque, to a certain extent, by a simple squirrel-cage winding. A new type of starting winding is now described and analyzed with which it is possible to attain both of these desirable characteristics.

If synchronous motors were called upon only to start a certain load, they could meet any reasonable condition without much trouble. Usually, however, the synchonous motor is also called upon to pull into step with various loads, depending upon the nature of load to which it is connected. This fact introduces the pull-in torque and the pull-in kva., which are just as important to arrange for as the starting torque and starting kva. In discussing the pull-in characteristics it should be kept in mind that, depending upon load and flywheel effect, it is necessary to bring synchronous motors starting as induction motors up to 92 to 96 per cent of their synchronous speed before a pull-in to synchronism is effected. As with induction motors, the synchronous motors are started up by using compensators or autotransformers to reduce the applied voltage. Full voltage applied at starting would draw prohibitively large current from the line, and the torque developed would in most cases be much in excess of that required.

As the torque and kva. drawn from the line vary with the square of the applied voltage, their values at reduced voltages can easily be computed from the diagram, which is based on full normal applied voltage.

Referring to Fig. 7, torque and kva. input curves at 50 per cent of normal voltage are plotted against per cent slip and show the effect of copper and brass in the squirrel-cage winding of a synchronous motor, the magnetic circuit of which is shown in Fig. No. 9. The torque curves, as plotted in full, show zero value at zero per cent slip. This would be the case if the rotor construction were similar to that of induction motors. As was pointed out, however, at the beginning of this discussion, a synchronous motor of the defined pole construction will run at synchronous speed and exert some torque without field excitation. The torque curves, therefore, in reality will run as indicated by the dotted lines. If the starting and pull-in duty of a synchronous motor are known, then these may conveniently be referred to curves as per Fig. 7 and the design of the squirrel-cage winding definitely settled. Referring again to Fig. 7, it is seen that if the motor required heavy starting torque but only a small pull-in torque, then a squirrel-cage winding with brass bars might be satisfactory. If, however, both the starting and pull-in torque required were rather heavy, copper bars should be used or a combination of copper and brass bars might give the most satisfactory results. Owing to the limited space of active or magnetic material in the rotor of the defined pole construction, the proportioning and distribution of the squirrel-cage winding—and thus the starting characteristics—depend more or less upon the pole span or pole embrace (ratio of pole arc to pole pitch). Fig. 9 shows the magnetic circuit of a 100-hp. synchronous motor having the same stator, but the rotor in one case has poles of 76 per cent, in the other case 66 per cent pole embrace. Fig. 6 (see first installment of article) shows the respec-

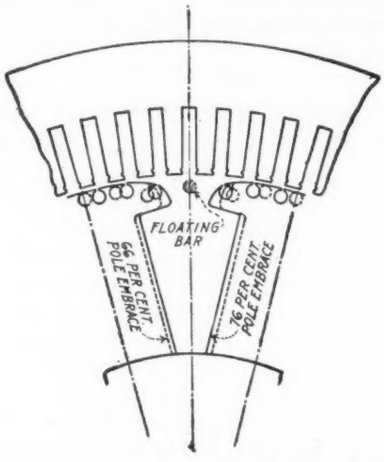
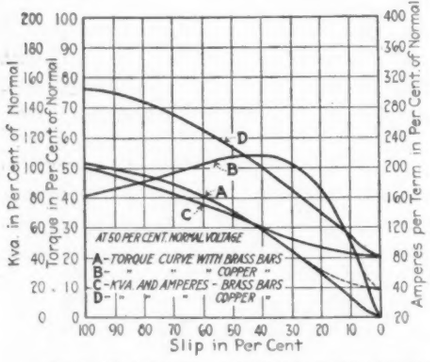
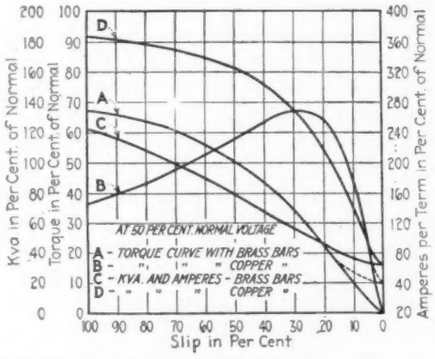



FIG. 9—MAGNETIC CIRCUITS FOR 66 AND 76 PER CENT POLE EMBRACE


Kva. in Per Cent of Normal
Torque in Per Cent of Normal
Amperes per Term in Per Cent of Normal
AT 50 PER CENT. NORMAL VOLTAGE
A - TORQUE CURVE WITH BRASS BARS
B - " " " COPPER "
C - KVA. AND AMPERES - BRASS BARS
D - " " " COPPER "
Slip in Per Cent


Kva. in Per Cent. of Normal
Torque in Per Cent. of Normal
Amperes per Term in Per Cent. of Normal
AT 50 PER CENT. NORMAL VOLTAGE
A - TORQUE CURVE WITH BRASS BARS
B - " " " COPPER "
C - KVA. AND AMPERES - BRASS BARS
D - " " " COPPER "
Slip in Per Cent

FIGS. 7 AND 8—STARTING CHARACTERISTICS FOR MOTORS WITH (7) 66 PER CENT, (8) 76 PER CENT POLE EMBRACE

100-hp., 2200-volt, three-phase, 60-cycle, 600-r.p. m. synchronous motor with squirrel-cage winding.

tive field forms of these rotors. The rotor bars in both cases are of the same size but not of the same number. Figs. 7 and 8 show the starting characteristics of this motor for 76 and 66 per cent pole embrace respectively. Fig. 10 shows the same characteristics, but here torque per kva. is plotted against per cent slip. These curves are interesting as they bring out clearly the importance which the compactness of the rotor construction has and also tend to verify the statement that good start-

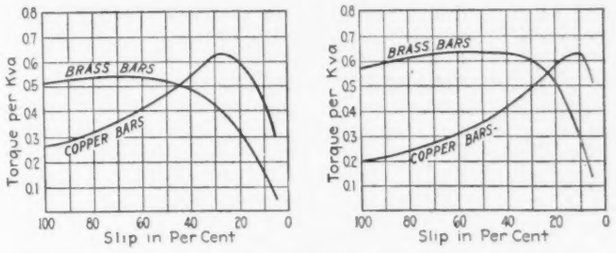



FIG. 10 — STARTING CHARACTERISTICS IN TERMS OF TORQUE PER KVA.
Same motor as in Figs. 7 and 8

ing characteristics can hardly be expected by "turning" a standard alternator into a synchronous motor by merely adding a squirrel-cage winding.

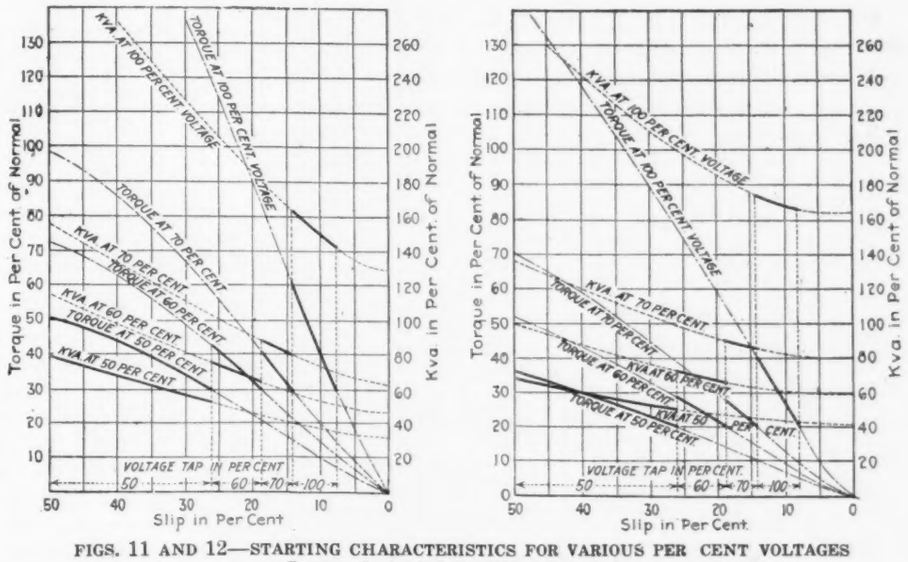
Let us now investigate what load this 100-hp. motor could pull into step with rotors having 76 and 66 per cent pole embrace when equipped with brass bars in the squirrel-cage winding. We will assume that it is required to bring the motor up to approximately 8 per cent slip before pull-in can be effected. Figs. 11 and 12 show starting characteristics constructed from Figs. 7 and 8 for 50, 60, 70 and 100 per cent voltage, or approximately at voltages corresponding to the taps of a standard auto-transformer. Referring to Fig. 8, which gives these starting characteristics for 76 per cent pole embrace, we note that the torque exerted at normal voltage is 30 per cent of normal at approximately 8 per cent slip. At this slip we are drawing approximately 142 per cent of normal kva. from line. If now the motor is started on the 50 per cent tap, carrying 30 per cent of its normal load, it will come up to approximately 26 per cent slip, drawing at this speed approximately 53 per cent of normal kva. from line. If we now throw over to the 60 per cent voltage tap, the motor will speed up to approximately 18.5 per cent slip, drawing at this speed approximately 65 per cent of normal kva. If 70 per cent of normal voltage is applied, the motor will speed up to approximately 14 per cent slip, drawing at this speed 80 per cent of normal kva. from line. Finally the motor will have to be thrown on full-line voltage in order to bring its connected load (30 per cent of normal) up to the required slip of 8 per cent. In a similar way Fig. 12 shows that the same motor, but equipped with 66 per cent pole embrace, would only be able to pull into step with 20 per cent of its normal load. It is interesting to note that the motor in this case is drawing considerably heavier current from the line than the same motor with 76 per cent pole embrace, although the pull-in torque is heavier in the latter case.

In order to improve somewhat a poorly proportioned and distributed squirrel-cage winding due to low percentage of pole embrace, a "floating" bar (or bars) is sometimes applied between the poles in the interpolar space (see Fig. 9). In some cases this construction may improve both the starting and pull-in torque, but the torque per kva. is low, and thus the current drawn from line is heavy. At the best this construction may be looked upon as a makeshift. It is obvious from the diagram and the characteristic curves that, with a motor equipped with the common squirrel-cage winding, it is hard, if not impossible, to secure both good starting and good pull-in characteristics.

### STARTING SYNCHRONOUS MOTORS UNDER LOAD

In order to eliminate this drawback, the writer has proposed and developed (patent applied for) a new, compounded squirrel-cage winding to be used in synchronous motors which require both high starting and pull-in torque without drawing excessive kva. from the line.

This object is attained by making use of two sets of bars in the pole face (see Fig. 13). The upper winding, the bars of which are nearest the air gap in the upper holes (marked $x$) in the pole punchings, is of high resistance but low reactance. The lower winding, the bars (marked $y$) of which are farther from the air gap, is of lower resistance, but as it is embedded deeper in the pole punching the reactance is high. At 100 per cent slip the current circulating in the squirrel-cage winding is of the same frequency as the primary current. The resulting high reactance of the lower winding will therefore permit only a small current to circulate, and the torque of the lower winding is thus weak at starting. The upper winding, however, because of its high resistance and low reactance, will develop a high torque at starting. As the motor speeds up the frequency of the current in the squirrel-cage winding will decrease and decrease the reactance of the lower winding. This will cause heavier currents to


KVA AT 100 PER CENT VOLTAGE
TORQUE AT 100 PER CENT VOLTAGE
TORQUE AT 70 PER CENT
KVA AT 70 PER CENT
TORQUE AT 60 PER CENT
KVA AT 60 PER CENT
TORQUE AT 50 PER CENT
KVA AT 50 PER CENT
VOLTAGE TAP IN PER CENT
50
60
70
100
Torque in Per Cent of Normal
Kva in Per Cent of Normal
Slip in Per Cent
KVA AT 100 PER CENT VOLTAGE
TORQUE AT 100 PER CENT VOLTAGE
KVA AT 70 PER CENT
TORQUE AT 70 PER CENT
KVA AT 60 PER CENT
TORQUE AT 60 PER CENT
KVA AT 50 PER CENT
TORQUE AT 50 PER CENT
VOLTAGE TAP IN PER CENT
Torque in Per Cent of Normal
Kva. in Per Cent of Normal
Slip in Per Cent

FIGS. 11 AND 12—STARTING CHARACTERISTICS FOR VARIOUS PER CENT VOLTAGES
Curves derived from Figs. 7 and 8.

circulate in the lower squirrel-cage winding, and the torque produced by this winding increases up to nearly synchronous speed, whereas the torque due to the upper winding will fall off as the speed increases. Fig. 14 shows the starting characteristics of the same 100-hp. motor discussed previously, equipped with the compounded squirrel-cage winding, and brings out clearly

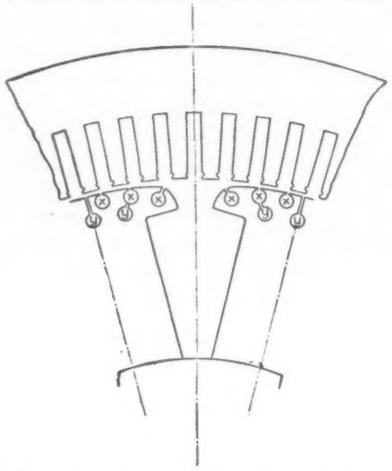


FIG. 13—SYNCHRONOUS MOTOR WITH COMPOUND SQUIRREL-CAGE WINDING

Magnetic circuit for 76 per cent pole embrace, 100-hp., 2200-volt three-phase, 60-cycle, 600-r.p.m. motor.

the good features of such a winding in connection with motors having heavy pull-in duty. Fig. 15 gives actual test results of this motor rated at 115 hp. Referring to the resulting torque curve (Fig. 14, curve C), it is desirable to eliminate or minimize the dip which occurs here at about 24 per cent slip. This is not always possible, due to limits set by mechanical reasons.

The slip, in per cent at which minimum torque will occur, is given by the equation:

$$\text{Slip} = 100/X_2 \sqrt{R_2(R_1 - R_2)}$$

Where:

$R_1$ = resistance of upper winding in ohms per phase, reduced to equivalent primary resistance.

$R_2$ = resistance of lower winding in ohms per phase, reduced to equivalent primary resistance.

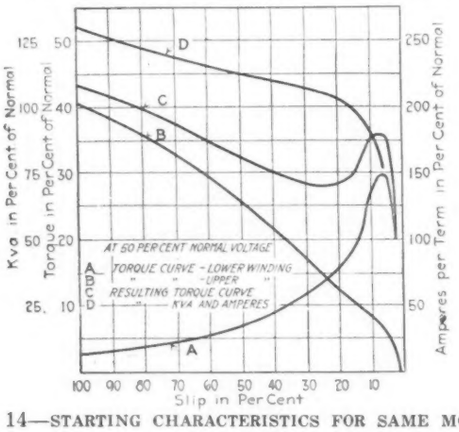

Kva in Per Cent of Normal
Torque in Per Cent of Normal
Amperes per Term in Per Cent of Normal
Slip in Per Cent
AT 50 PER CENT NORMAL VOLTAGE
A TORQUE CURVE - LOWER WINDING
B " " - UPPER "
C RESULTING TORQUE CURVE
D " KVA AND AMPERES

FIG. 14—STARTING CHARACTERISTICS FOR SAME MOTOR AS IN FIG. 13

$X_2$ = reactance of the lower winding in ohms per phase, reduced to equivalent primary reactance.

Fig. 16 shows the assembled field of a 500-hp., 360-r.p.m. synchronous motor equipped with compounded squirrel-cage winding. Referring to Fig. 13, it is seen that slots are punched in the pole punchings from the lower holes to the rotor surface in order to force part of the alternating flux to interlink with the bars of this winding and to give the lower winding the proper reactance. By carefully designing the compounded squirrel-cage winding to get the proper ratio of resistance and reactance it is possible to build synchronous motors that will pull into step carrying full rated load with approximately 200 per cent of normal kva. drawn from line. This feature will obviously broaden the commercial field of application of the synchronous motor and also eliminate the clutches which sometimes were necessary with synchronous-motor drives.

## STABILITY AND PULL-OUT CHARACTERISTICS

The stability, limit of stability or pull-out torque of a synchronous motor depends directly upon the angle of lag which exists between the alternating-current and direct-current field, or the displacement angle between the line voltage and the motor emf. This angle of lag depends upon the load, the line voltage and the motor emf. If there was no lag between the alternating-current and direct-current field, the line voltage and

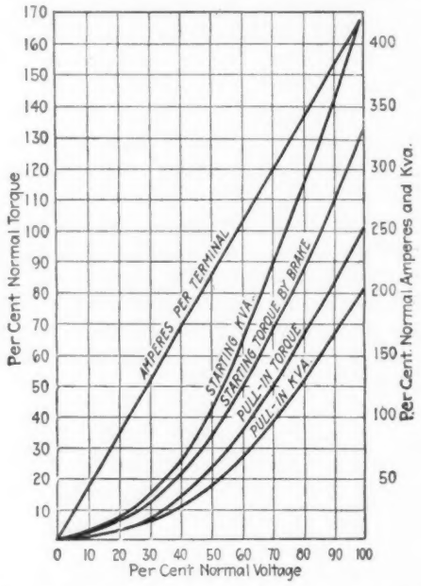



FIG. 15—STARTING AND PULL-IN TORQUES AS FUNCTIONS OF APPLIED VOLTAGE

For 115-hp., 2200-volt, three-phase, 60-cycle, 600-r.p.m. motor.

the motor emf. would be in exact phase opposition and only a wattless current would circulate in the armature winding of the synchronous motor. This wattless current would be leading or demagnetizing on the motor field if the motor emf. was larger than the line voltage; it would be lagging or magnetizing if the line voltage was in excess of the motor emf. As the current in either case, however, is wattless, it could produce no torque, and the motor therefore could not carry any load whatever if the displacement angle was zero. As the motor is loaded, however, the rotor will lag back sufficiently to cause a displacement between the line voltage and motor emf. that will send a current through the armature winding of the synchronous motor, the watt component of which will produce a torque that will balance the load on the motor. With a given line voltage and constant field excitation, the sine of the displacement angle varies directly with the load.

In Fig. 17, which refers to the 100-hp., 600-r.p.m synchronous motor previously discussed, vector *O-A* rep-

resents the line voltage; vector *O-B* the motor emf., *E*, which corresponds to the field excitation for 100 per cent load at 100 per cent power factor. Vector *A-B* represents the resulting voltage, which vectorially balances the diagram. This resulting voltage causes a current, *I*, to flow through the armature winding of the synchronous motor, where $I = A\text{-}B/Z$ = current per

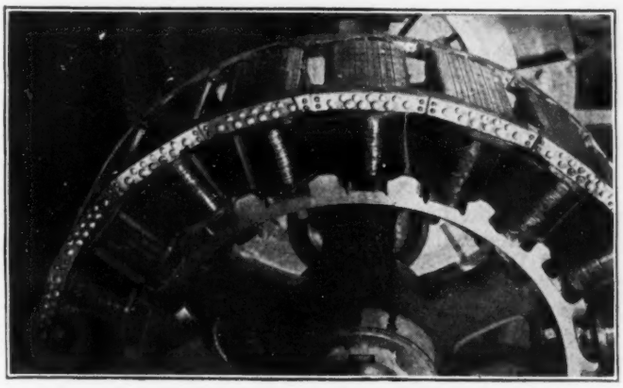


FIG. 16—SYNCHRONOUS MOTOR ROTOR WITH COMPOUND POLE-FACE WINDINGS

phase, *Z* is the synchronous impedance equal to $\sqrt{R^2 + X^2}$, *R* being the resistance and *X* the reactance per phase in ohms. As the reactance is by far larger than the resistance, the impedance angle, ø, is very small, and therefore the vector $I \times Z$ will lag approximately 90 deg. behind the current vector *I*.

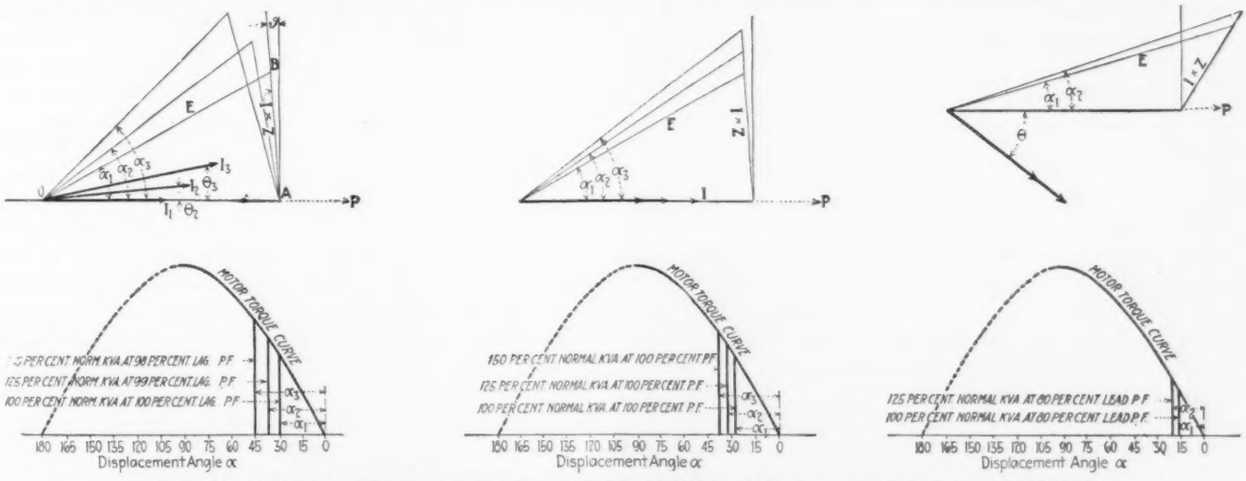
Fig. 17 and the accompanying table give the displacement angle $\alpha$ for three load conditions while keeping the line voltage and motor emf. constant. They also give the relation between these different load conditions and the corresponding values of the displacement angle and show the overload capacity or the pull-out torque, which will occur at $\alpha = 90$ deg. Only values of $\alpha$ between zero and 90 deg. can be considered, as the dotted part of the motor torque curve from 90 deg. to 180 deg. is unstable. Fig. 18 shows the same load conditions as Fig. 17, but the field excitation for each load condition is now adjusted to give 100 per cent power-factor operation. It is to be noted that the displacement angle, $\alpha$, is increased and thus the overload capacity reduced at lagging power factor. If, however, the motor should be overexcited or operate at leading power factor, the displacement angle will decrease materially and thus the instantaneous overload capacity is increased by over-excitation. Referring to Fig. 19, it is seen that the displacement angle of the motor when carrying its full rated kilowatt load at 80 per cent leading power factor is 18 deg., as against 29 deg. when the motor is carrying the same load but at 100 per cent power factor.

DEPENDENCE OF DISPLACEMENT ANGLE UPON EXCITATION AS INDICATED IN FIGS. 17, 18 AND 19

| | Fig. 17 | | | Fig. 18 | | | Fig. 09 | |
|---|---|---|---|---|---|---|---|---|
| Displacement angle $\alpha$ | 29° | 36° | 45° | 29° | 33° | 37° | 16° | 18° |
| Load, per cent of normal kva | 100 | 125 | 150 | 100 | 125 | 150 | 100 | 125 |
| Per cent power factor, cos $\theta \times 100$ | 100 | 99 | 98 | 100 | 100 | 100 | 80 | 80 |
| Motor emf. in per cent normal, *E* | 111 | 111 | 111 | 111 | 115 | 120 | 128 | 133 |
| Impedance drop in per cent normal voltage, *IZ* | 54 | 67 | 81 | 54 | 63 | 72 | 42 | 49 |

If test data, as per Fig. 5, are available, the displacement angle for different load conditions of the motor, when line voltage, current and power factor are known, may easily be found by means of the vector diagram. The line voltage is conveniently taken as zero axis and the current vector laid off as to magnitude and power factor. The impedance drop is now added vectorially to the line voltage. The impendance angle ø is known since sine ø = ohmic drop ÷ inpedance drop = $(I \times R)/(I \times Z)$. The resistance per phase, *R*, is found from the short-circuit losses and is for a three-phase machine equal to watts loss ÷ $(I^2 \times 3)$.

The third vector, which closes the triangle, is the motor emf. which corresponds to the actual excitation required as found from the no load saturation curve. As pointed out, operation of the motor at leading power factor will decrease the angle of lag and thereby insure greater stability of operation. On the other hand, however, the motor is drawing a heavy current from the line and the excitation is high, thereby increasing the heating of the motor. Furthermore, the efficiency is considerably lower when running overexcited than when operating at 100 per cent power factor. In cases where condenser effect is desired it may be very satisfactory to operate at leading power factor.


E
B
A
P
MOTOR TORQUE CURVE
150 PER CENT. NORM. KVA AT 90 PER CENT. LAG. P.F.
125 PER CENT. NORM. KVA AT 99 PER CENT. LAG. P.F.
100 PER CENT. NORM. KVA AT 100 PER CENT. LAG. P.F.
150 PER CENT. NORMAL KVA AT 100 PER CENT. P.F.
125 PER CENT. NORMAL KVA AT 100 PER CENT. P.F.
100 PER CENT. NORMAL KVA AT 100 PER CENT. P.F.
125 PER CENT. NORMAL KVA AT 80 PER CENT. LEAD P.F.
100 PER CENT. NORMAL KVA AT 80 PER CENT. LEAD P.F.
180 165 150 135 120 105 90 75 60 45 30 15 0
Displacement Angle α

FIGS. 17, 18 AND 19—VECTOR DIAGRAMS AND DISPLACEMENT ANGLE AS AFFECTED BY EXCITATION. LINE VOLTAGE CONSTANT IN ALL CASES

(17) Three different loads; excitation set for 100 per cent load at 100 per cent power factor.
(18) Same loads as in (17); excitation adjusted each time for 100 per cent power factor.
(19) Motor overexcited to give 80 per cent leading power factor.

# Outdoor Substations for Intercounty Development

## Utility Makes Use of Convenient Method by Which to Serve Small Communities Without Great Expense in Cases Where Line Voltage Is Too High for Regular Pole Connection

DESIRING to connect up all business contiguous to its lines within a radius of 100 miles (160 km.) of St. Louis and having many transmission lines operating at too high a voltage for small tap-offs, the Union Electric Light & Power Company has developed a substation through which small groups of consumers can be served from 26,400-volt circuits economically. The combined efforts of the utility's and the manufacturer's engineers resulted in a 4000-kva. steel outdoor substation structure which cost $1,050 installed in 1917. This is at the rate of about 26 cents per rated kilowatt, exclusive of electrical equipment and connections. The installations now in use are equipped with transformers rated at only 1000 kva., but the structures were designed to provide for the future development of a territory extending over about 5000 square miles (1,295,000 hectares) and having a population of from 1,000,000 to 2,000,000 people. A substation structure was required which would carry two through transmission lines, also five three-pole switches to tie the lines together and to permit either incoming line to be cross-connected with either outgoing line. A three-wire transformer bus for 13,200 volts or 26,400 volts was required to feed distribution transformers and a 2300-4000 volt four-wire bus was needed to distribute service from the low-tension side of the distribution transformers. It was also necessary to mount on the framework choke coils, disconnecting switches and insulators for distribution lines radiating from the station.

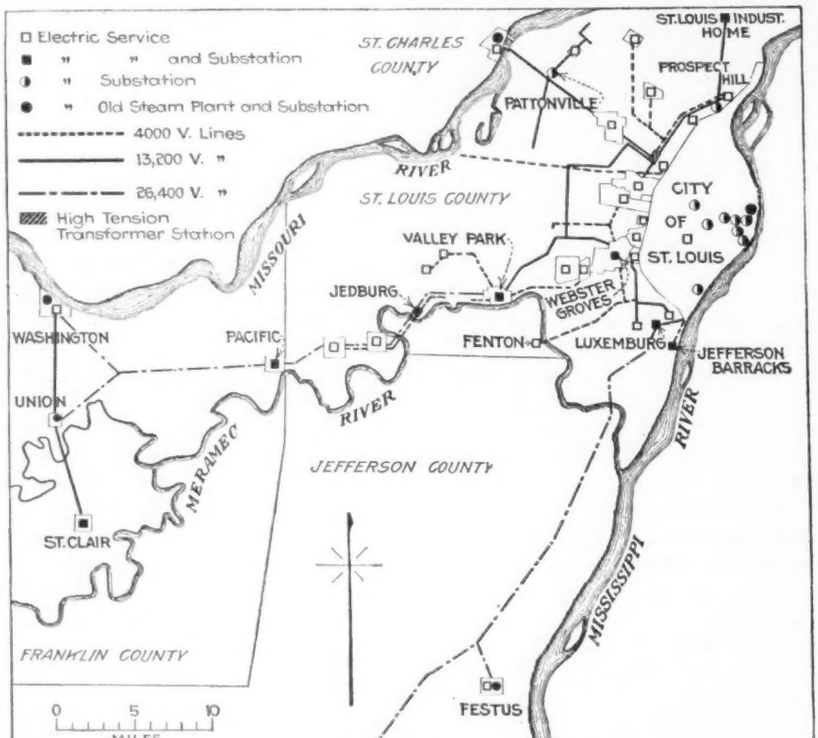



FIG. 1—INTERCOUNTY TRANSMISSION SYSTEM OF ST. LOUIS UTILITY

In addition to the equipment mounted on the structure, provision had to be made for setting transmission and distribution transformers and lightning arresters on a concrete floor under the steel work. The structure had to meet all these requirements, and at the same time it had to be inexpensive, simple, rugged, durable and made of standard material which could be easily replaced.

The substation which most nearly met these requirements for transmission line usage is shown in Figs. 2 to 10 inclusive. Eight have been installed within the past two years at Valley Park, Jedburg, Pacific, Washington, Union, Luxemburg, De Soto and Festus, Missouri, with slight differences in equipment to meet local conditions. The location of the towns named with relation to each other and to St. Louis is shown on the map of the intercounty transmission system (Fig. 1). The substations have proved easily adaptable to any conditions with which the company has met. The cost of installation was comparatively small, being merely the expense of constructing a foundation for the steel work, on which equipment could be placed, and assembling the individual parts. A neat-appearing, strong, compact, fireproof, easily enlarged, long-lived structure was the result, whereas the wooden-pole substations are not so neat, are comparatively short-lived, more subject to the elements and liable to serious damage by fire from the arcs or outside sources. Wooden-pole substations are still used by this company for individual consumers and for groups of consumers where a simple step-up or step-down transformer station is required for a maximum potential of not over 13,200 volts. One of these four-pole wooden substations which is at Pattonville is shown in Fig. 3.

The outdoor steel structure has proved more desirable in transmission substations where higher voltages are involved, more apparatus is required and a greater territory served. The steel station is also preferred where a large load is supplied and continuity of service is of great importance. Attempts to design outdoor wooden substations as strong in all respects and with all the equipment of a steel station usually result in a bulkier and unsightly arrangement.

The substations which were adopted are of the Bates expanded-steel pole design. Each station has six vertical supports inclosing a ground space of 12 ft. by 42

ft. 8 in. (3.7 m. by 13 m.). The overhaed framework is 24 ft. by 48 ft. (7.3 m. by 14.6 m.), and its height above the ground is 25 ft. (7.6 m.). The complete equipment for each substation consists of four type PM Delta-Star

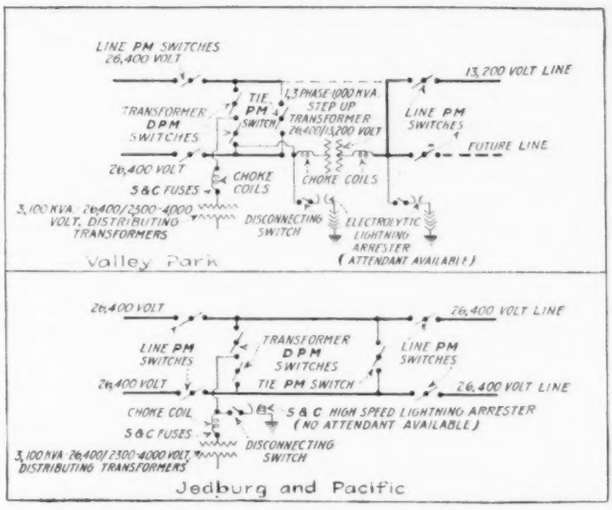



FIG. 2—OUTDOOR TWO-CIRCUIT STEP-UP AND STRAIGHT-THROUGH DISTRIBUTION SUBSTATIONS WITH TRANSFORMERS AND ARRESTERS

33,000-volt, 200-amp., three-pole double-break-per-phase air-break switches complete with operating rods, locking handles and special underframing. Two of these switches are used for disconnecting and sectionalizing each of the two transmission lines. For tying the two lines together a type DPM double-break-per-phase, double-blade, double-throw switch of the same capacity is pro-

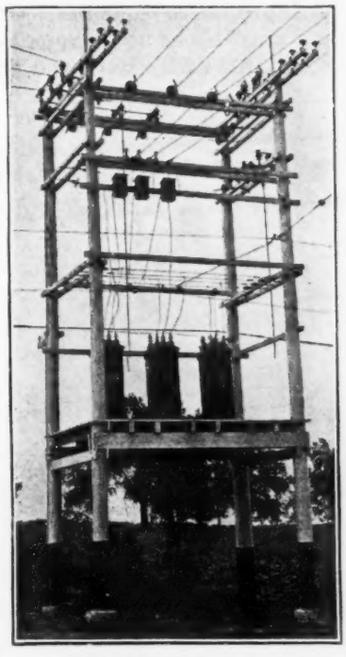


FIG. 3 — WOOD-POLE 13,200-VOLT DISTRIBUTION SUBSTATION WITH INSULATORS FOR SECOND THROUGH CIRCUIT IN UPPER FOREGROUND

vided. Type GF single-pole, 33,000-volt, 200-amp., long-turn, cylinder-form choke coils and mountings for carbon tetrachloride fuses are in series with the transformers. The high-tension bus consists of 0.25-in. (6.35-mm.) galvanized-iron pipe and fittings, which were much cheaper and just as effective as copper.

In outlying substations where there is no local agent Schweitzer-Conrad type SC three-phase, 33,000-volt high-speed, sphere-gap, graded-resistance arresters are mounted on galvanized-iron pipe framework for protec-

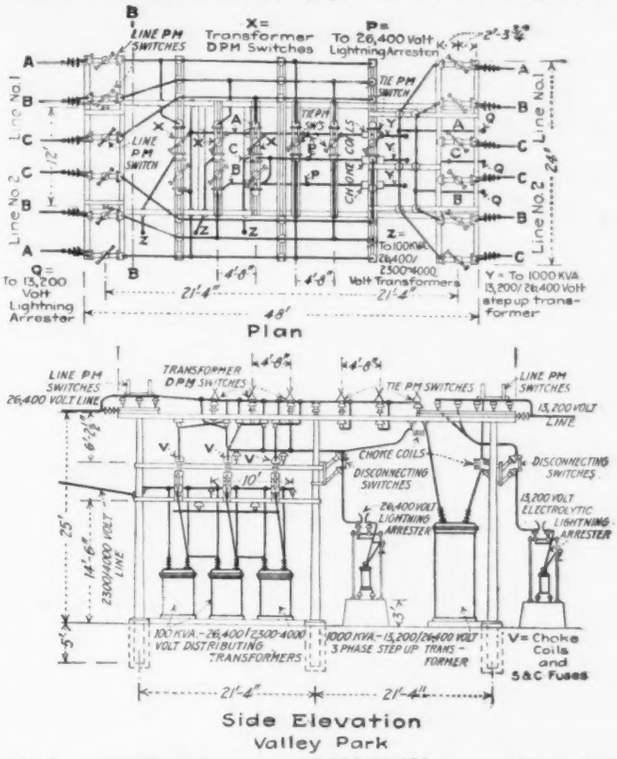



FIG. 4—OUTDOOR TWO-CIRCUIT 13,200-26,400-VOLT STEP-UP AND DISTRIBUTING SUBSTATION (SAME AS FIG. 5)

tion against lightning. Where the services of a local agent can be secured to charge the arresters daily without great additional expense or inconvenience to the company, as is the case at the Valley Park step-up and distributing substation, outdoor-type General Electric electrolytic lightning arresters are used. At this par-

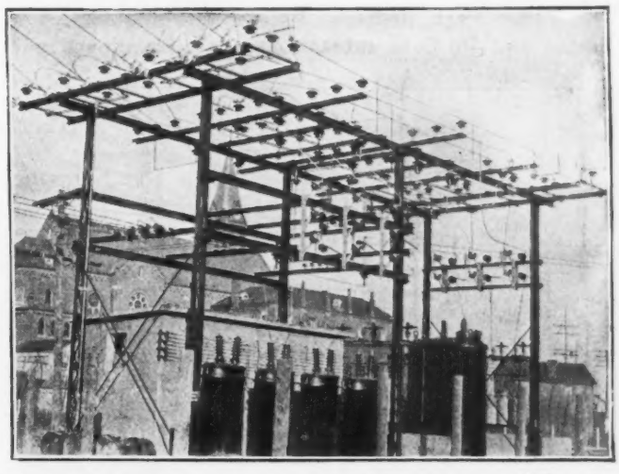


FIG. 5—OUTDOOR STATION WITH THREE-PHASE STEP-UP AND ONE-PHASE DISTRIBUTION TRANSFORMERS AND SECONDARY CONTROL HOUSE (SAME AS FIGS. 4 AND 10)

ticular station two arresters are used, one on the 13,200-volt side and one on the 26,400-volt side of the 1000 kva., three-phase, 60-cycle step-up transformer, which is connected delta on the primary side and star on the secondary.

From its high-tension side this transformer supplies

five banks of three 100-kva., 13,200-26,400/2300-volt, one-phase, 60-cycle outdoor type H General Electric transformers, with 5 per cent taps above, and below 26,400 volts of four 2.5 per cent taps on the 13,200-volt winding. Transformers rated at 100 kva. are the

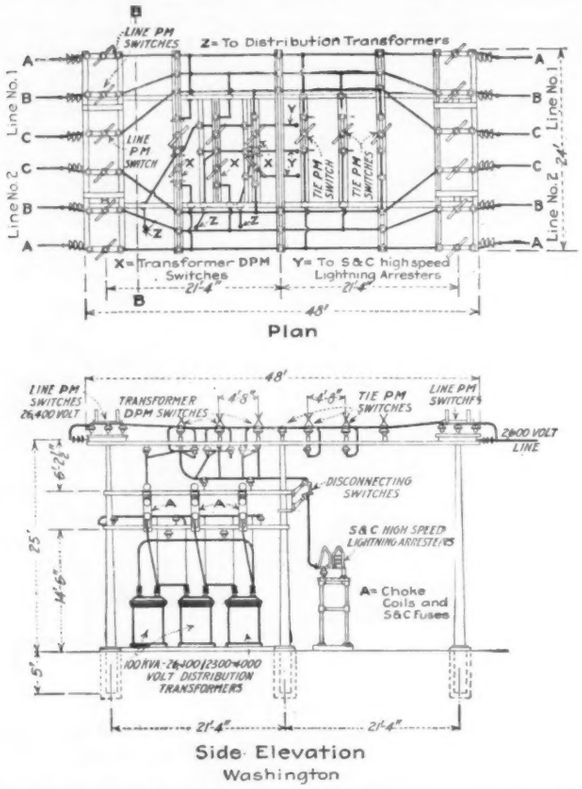



FIG. 6—OUTDOOR SUBSTATION WITH TWO STRAIGHT-THROUGH LINES, DISTRIBUTION TRANSFORMERS AND GAP RESISTANCE ARRESTER (SAME AS FIGS. 7 AND 8 FOR STATION)

smallest size used to supply the 2300-4000 four-wire networks radiating from each substation even when the load could be carried by much smaller transformers. The Valley Park, Jedberg, Pacific, Washington, Union, Festus and De Soto substations are all equipped with

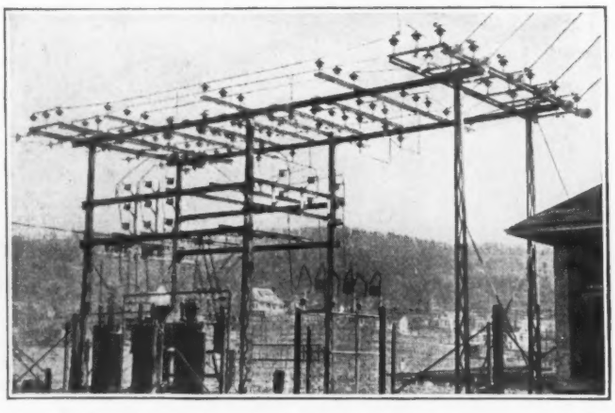


FIG. 7—OUTDOOR DISTRIBUTION SUBSTATION WITH TWO 26,400-VOLT STRAIGHT-THROUGH CIRCUITS

sets of three 100-kva. transformers. A spare transformer is kept on the foundations at Valley Park, Pacific, Union and De Soto ready for immediate connection in case of trouble in the bank in service. The spares are at strategic points from which the transformers can be taken to other substations when needed.

An automatic induction regulator is installed on the lighting service supplied from each substation. If the load is small or comparatively unimportant, outdoor transformer type of regulators are used. However, when the lighting load warrants the installation of in-

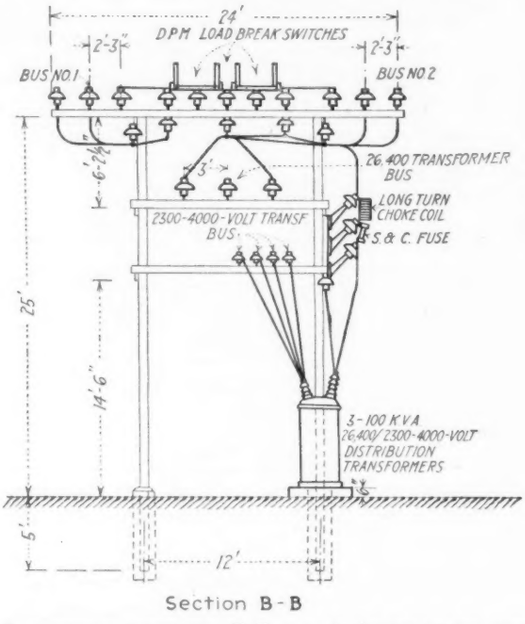



FIG. 8—SECTION THROUGH *B-B* FIG. 6 (SIMILAR TO SECTION *B-B* FIG. 4)

door automatic motor-operated induction voltage regulators an inclosure was erected, adjacent to the outdoor substation, of sufficient size to house all the 2300-4000-volt control and protective equipment unless an old power house was available as at De Soto, Festus, Washington and Union. At Valley Park and at Luxemburg

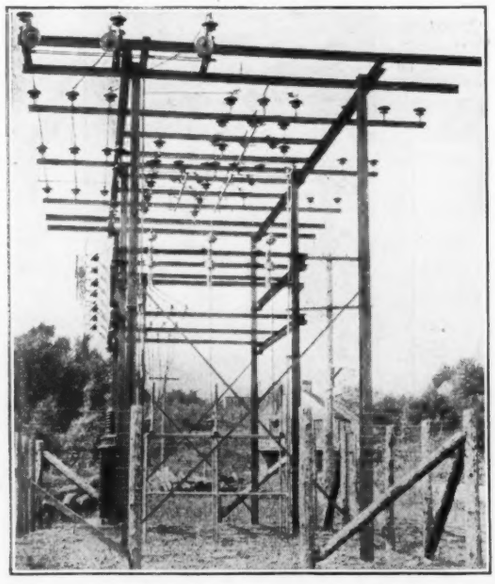


FIG. 9—VIEW OF SUBSTATION LIKE FIG. 7 EXCEPT THAT THERE IS ONE CIRCUIT INSTEAD OF TWO

the switch house was built out of 8-in. (20.3-cm.) hollow tile with stucco-finished walls, a reinforced-concrete floor and a similarly constructed roof, through which the entrance bushings extend. The inside dimensions are approximately 9 ft. by 17 ft. by 9 ft. (2.8 m. by 5.3 m. by 2.8 m.). These buildings serve to house the automatic

induction regulators, oil switches, metering equipment, disconnecting switches, choke coils and multigap lightning arresters, all of which are installed on the 2300-volt side of the distributing transformers. Outdoor metering outfits are employed when load conditions do

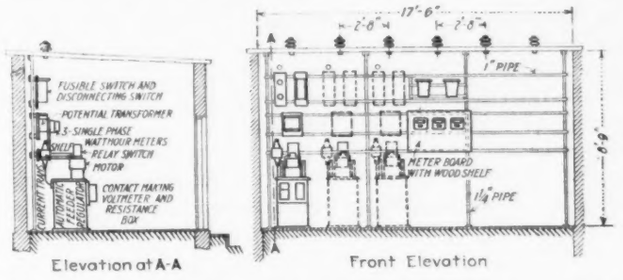



FIG. 10—DISTRIBUTION, METERING AND CONTROL EQUIPMENT HOUSE SHOWN IN FIG. 5

not justify the use of equipment which must be housed and operated indoors. All metering is done on the 2300-4000-volt side of the distribution transformers, all losses of transmission and transformation being absorbed by the transmission company.

TABLE I—DETAILED COSTS OF VALLEY PARK SUBSTATION WITH SWITCHBOARD

| | Material | Labor | Freight Handling and Sundries Handling | Total |
|---|---|---|---|---|
| Steel structure | $560 | $275 | $90 | $925 |
| Concrete piers and foundation | 75 | 40 | 10 | 125 |
| Tile and stucco switch house | 155 | 85 | 10 | 250 |
| Switches, buses, two electrolytic arresters, etc. | 2,601 | 293 | 150 | 3,044 |
| Meters, regulators, etc. (indoors) | 756 | 261 | 106 | 1,123 |
| Oil treating and filtration apparatus, etc. | ..... | 60 | 20 | 80 |
| Fence | 245 | 75 | .... | 320 |
| Total, excluding transformers | $4,392 | $1,089 | $386 | $5,867 |
| One 1000-kva. three-phase and four 100-kva. one-phase, 60-cycle transformers | 5,515 | 325 | 150 | 5,990 |
| Grand total | $9,907 | $1,414 | $536 | $11,857 |

As a safety measure each substation is inclosed by a 7-ft. (2.1-m.) fence to keep children and stray cattle from coming in contact with the high-voltage equipment. The inclosure is made of galvanized-iron 11BWG woven

TABLE II—DETAILED COSTS OF OUTDOOR SUBSTATIONS WITHOUT SWITCH HOUSE

| | Material | Labor | Freight Handling and Sundries | Tota |
|---|---|---|---|---|
| Steel structure | $560 | $275 | $55 | $890 |
| Concrete piers and foundations | 50 | 40 | 10 | 100 |
| Switches, buses, one gap resistance arrester, etc. | 1,706 | 351 | 90 | 2,147 |
| Meters, etc. (outdoors) | 225 | 30 | 11 | 266 |
| Oil-treating and filtration, apparatus, etc. | ..... | 20 | 5 | 25 |
| Fence | 250 | 50 | .... | 300 |
| Total excluding transformers | $2,791 | $766 | $171 | $3,728 |
| Three 100-kva., one-phase transformers | 2,115 | 125 | 60 | 2300 |
| Grand total | $4 906 | $891 | $231 | $6,028 |

wire fencing with 7BWG pickets supported on a 2-in. (51-mm.) galvanized-iron framework. At each end is a gateway made of the same material as the fence.

All these substations were purchased during the first half of 1917, and the prices given in Tables I and II are those which prevailed at that time.

The Luxemburg substation is similar to the one at Valley Park except for transformers. If transformer costs are excluded, the Valley Park costs may be used for both stations. The costs for the other four stations on the Valley Park line are given in Table II. Except for the stations at Union and Washington, which are equipped for only a single-circuit at present, the stations on this line are equipped for two through circuits.

Four-post outdoor substations could be substituted for the six-post structures which have been described wherever the transmission voltage is not changed except for distribution purposes and no line-switching equipment other than transformer disconnection is required, as at the end of a line. The saving of structural steel, labor of installation and sundries would amount to about $195. However, the company does not consider the saving sufficient to offset the extra cost of increasing the size of the structure at some other time. Furthermore, with the standard construction the line can be extended at any time without delay.

## THE PROPER LOADING OF DISTRIBUTION TRANSFORMERS

### For Best Operating Economy Transformers Must Be Continuously Loaded Nearly to Limit Determined by Maximum Operating Temperature

BY FRANK A. ROBBINS
Electrical Engineer Superior (Wis.) Water, Light & Power Company

BOTH the city and the business of the company with which the writer is connected have been growing so rapidly that many distributing transformers have become badly overloaded. A problem has arisen, therefore, to find a satisfactory method of determining the load on a given transformer and also the maximum safe load it is possible to carry. One method is being tested which involves placing self-registering maximum-temperature thermometer against the coils of a transformer for a period of several days and reading the maximum temperature reached during that time. This method is believed to be more satisfactory than other methods usually employed because any load can be carried if no point in the transformer exceeds 105 deg. C. If the load is not continuous or the surrounding air is less than 40 deg. C., the safe maximum load for a transformer may be considerably more than the rated load. The important thing to know is not whether the maximum load is 50 per cent or 150 per cent of rated load, but whether or not the transformer is overheated. Therefore, the use of a self-registering thermometer is the most direct and logical method of testing transformers, in the opinion of the writer.

While the insulating materials used in transformers can withstand a temperature of 105 deg. C., it is impossible to place the thermometer at the point of highest temperature, so that some lower recorded temperature must be taken as the maximum safe temperature. The standardization rules of the American Institute of Electrical Engineers specify a temperature of 15 deg. C. less, or 90 deg. C. There are so many variations in outside temperature and in load, however, that the

* From a paper read by the author before the Wisconsin Electric Association.

writer feels that 65 deg. C. is as high as should be allowed in actual practice.

A surrounding temperature of 40 deg. C., or 104 deg. Fahr., which is specified by standardization rules, often occurs in crowded stations, but practically never in distributing transformers on poles during periods of heavy loads. This makes it safe to carry a little overload on lighting transformers even in the summer time. In the winter months the load increases greatly, but the cooler weather also increases the ability of the transformer to carry overloads. Statistics for maximum temperatures during the lighting peak are not readily obtainable, but an idea of the surrounding temperatures which are likely to occur in Wisconsin, where the system under consideration is situated, is given below, in degrees Fahrenheit:

| | Superior | Chicago | | Superior | Chicago |
|---|---|---|---|---|---|
| January | 18° | 31° | July | 74° | 80° |
| February | 22 | 33 | August | 71 | 77 |
| March | 32 | 41 | September | 64 | 71 |
| April | 46 | 54 | October | 52 | 57 |
| May | 58 | 64 | November | 36 | 45 |
| June | 69 | 74 | December | 25 | 36 |

Chicago has on the average nine days per year with a temperature above 90 deg., and Superior has less than two such days a year.

During the summer months the lighting peak is of such short duration, especially when the daylight-saving law is in force, that transformers do not have time to reach their full operating temperature. The rate at which distributing transformers heat up when full load is applied to a cold transformer and held constant in a room temperature of 40 deg. is indicated by the following:

| Hours | Coil Temperature | Hours | Coil Temperature |
|---|---|---|---|
| 0 | 40 deg. C. | 3 | 56.5 |
| ½ | 45 | 3½ | 58 |
| 1 | 49 | 4 | 59 |
| 1½ | 51 | 4½ | 60 |
| 2 | 53 | 5 | 61 |
| 2½ | 55 | 10 | 64 |

From these tables it is evident that when the load lasts for only about three hours a considerable overload is permissible.

No doubt, most distribution engineers consider fall the proper time to check up transformer capacities, since that is the time of load increase and because transformers fail from overload in the early winter. However, the writer is not sure whether the damage is done by high loads in the fall and early winter or by the combination of high surrounding temperature and moderate loads in summer. In this connection there is one thing that is likely to be forgotten. A transformer may be badly overloaded for a time and come through without failure, but it has probably been seriously injured and is ripe for failure at some later date. For this reason it seems advisable to run a series of tests on transformers carrying typical loads under both summer and winter conditions to determine at what season of the year a transformer reaches the highest temperature.

A few years ago the writer conducted some tests which indicated that if a transformer is surrounded by air at 0 deg. C., or freezing, it is possible to carry a 50 per cent overload continuously without the transformer becoming as hot as when run at rated load and standard temperature. These tests were conducted with great care, temperatures being taken by the resistance method as well as by several thermometers. Furthermore, they were conducted on several transformers and the runs made at several different loads. The tests were run on old-style transformers, and it would not be safe to overload new transformers to the same extent.

Occasionally a transformer is installed in an underground vault where ventilation is poor and the surrounding air reaches very high temperatures. In such cases any method which measures the electrical load only is unsatisfactory because even part load may overheat the transformer. If transformers are supplying a variable load, such as some power installations, it is sometimes rather difficult to determine with any degree of satisfaction whether a transformer is overloaded. Here again the thermometer is of assistance in determining safe operating conditions.

Another condition under which it is more desirable to take temperature readings than measure load is when transformers which have been rated by the old as well as the recent standardization rules are employed. The older rules are much more liberal than the new, hence the older transformers can stand heavier loads for a given rating. This difference in overload capacity is automatically taken into account by measuring the temperature.

The thermometers used should have the scale etched on the glass, with no metal exposed to cause short circuit. The registering feature should be the same as that used on clinical thermometers. It is useless to expect satisfactory results with ordinary thermometers, because the mercury drops so rapidly after the bulb is removed that it would be impossible to get accurate readings. Some care must be used in placing the thermometer, the best place being in an oil duct between windings. This can usually be done in the newer and smaller transformers. The next best way is to let the bulb rest on the top of the core. In this way it has been possible to get consistent results, although it has taken a little experience for the linemen to learn to place the thermometer properly. The atmospheric temperature should, of course, be noted and allowed for.

The test is not a particularly expensive one, especially as it permits an inspection of the transformer oil at the same time. It is not the plan of the writer to test any and all transformers indiscriminately, as this would be too expensive. If it is felt that a transformer should be changed, it is tested first to determine the size of equipment to put in its place. To aid in selecting the transformers which are most likely to be overloaded, the following rules applying to residence lighting consumers are observed:

The maximum demand in watts of $N$ consumers is $400 + 160N$, and a 40 per cent overload is permitted before it is thought necessary to test the transformer. This is equivalent to saying that the demand of one consumer is equal to a little more than one flatiron. If twenty consumers are supplied from one transformer, their demand will be 3.6 kw. and their diversity factor is 3.1. (This diversity factor is practically that found by H. B. Gear in his investigations on residence consumers in Chicago.)

The foregoing rule is, of course, a rough rule of thumb, but it has come surprisingly close to facts in both the better and poorer parts of our city. If used with a reasonable amount of common sense, it is believed that this rule will serve the purpose admirably as a method for estimating the load on transformers, and it is simpler and more satisfactory than basing the demand on a certain fraction of the connected load.

By using the above method it should not be necessary to test more than 15 per cent of the transformers in any one year. Probably many consider this too often and feel that the cost of testing is not warranted.

However, assume that there are 100 transformers in service and that fifteen are tested each year at a cost of $1 each—a high figure, especially if the inexpensive thermometer test is used. The total cost of testing would be $15. If by this testing the installation of only one 1-kw. transformer could be saved, it would pay more than twice the cost of the testing. Suppose also that in a given locality there is installed one 7½-kw. transformer where a 5-kw. unit would be sufficient. The difference in cost is about $25. Assuming the fixed charges on this investment are 12 per cent, the 7½-kw. transformer has an annual investment charge of $3 more than the smaller one. The 7½-kw. transformer also has about 14 watts greater core loss, which at $0.01 per kilowatt-hour is $1.23 per year. The difference in annual cost of the two transformers is $4.23. A few cases where transformers larger than necessary are used would cause an annual loss to the company greater than the cost of the proposed method of testing.

Summarizing, it may be stated that it is the writer's belief that to secure the best operating economy it is essential to keep all distributing transformers loaded nearly to their limit. That limit is defined, not by the rated capacity, but by the maximum safe temperature. How nearly this maximum safe temperature is reached is best determined by a self-registering thermometer. A limited amount of testing is a very wise expenditure.

# Park and Boulevard Lighting in Portland

## An Artistic Effect Has Been Arrived at by the Employment of Concrete Posts with Alba Globes—Substations Combined with Comfort Houses and Tool Shelters Are a Feature—Steel-Armored, Lead-Covered Underground Cable Used

BY F. H. MURPHY

THE policy of having a uniform system of lighting for parks and boulevards is undoubtedly a beneficial one for large and growing cities as it avoids a great deal of confusion each time a new park or boulevard is to be lighted as well as the expense of calling in a consulting engineer in each individual case and the possibility of having several different systems to maintain.

Considered from the distribution standpoint, a lighting system which is satisfactory for boulevards will usually prove to be best for park lighting. The distribution problems are similar. The circuits must be carried underground, continually subjected to moisture; the lighting units are placed at widely varying distances from the service, some at relatively great distances, and the sources of service are necessarily few and far between. Since there does exist such a uniformity of general requirements, the wisdon of calling for expert engineering advice to determine the best system of distribution to adopt as a standard is at once apparent. Otherwise, as each installation comes up for consideration the officials are confronted anew with a maze of systems and prices, and they must select from among these what presumably is the best plan for the city in each particular case. Consequently in a short time they have acquired a heterogeneous collection of lighting systems, each with its own peculiar maintenance maladies.

After two or three very unsatisfactory experiences of this nature, the park superintendent of Portland, Ore., determined to call in an engineer to decide upon a proper system and one which could be used universally. As a result the system of which a description follows was adopted. Since the electric lighting company had 2300-volt, 60-cycle, single-phase, alternating-current service available in the vicinity of every location at all likely to use this system, it was decided that the city should purchase the energy at this voltage. Furthermore, this was the most desirable voltage for the system selected, which was a 6.6-amp., constant-current, series-incandescent system.

The substation which had to be provided to house the transformer and switchboard is perhaps the most novel feature of the system. Since it was also necessary to provide comfort stations and a housing for the tools used in caring for the park or boulevard, these various features, together with the substation, were placed under one roof and the building was designed to be as harmonious as possible with its surroundings. Each station is divided into four rooms, of which the substation proper occupies only one. The first one built is shown in Fig. 1, while one of the later and more elaborate types is shown in the lower corner of the picture illustrating park lighting (Fig. 2).

The service consists of a two-conductor lead-sheathed cable of No. 8 B. & S. gage, stranded copper wire, insulated for 2300 volts, which is carried in unlined metal conduit from the back of the switchboard panel in the substation underground to the electric lighting company's pole and up the pole to the primary cross-arm. The cable terminates both at the primary cross-arm on the pole and in the substation in approved single-conductor open-air tunnels. Constant-current transformers designed to operate on a 2300-volt, 60-cycle primary and to deliver a constant current of 6.6 amp. on the secondary side are employed. These transformers are required to meet all the purposes of operation, regulation, insulation and temperature rise which are required of standard transformers of this type. The details of these, however, need not be given here. The switchboard is made of 1½-in. (3.8-cm.) blue Vermont marble mounted on a self-supporting iron frame and equipped with an ammeter connected directly in series with the secondary circuit, as well as a full complement of both primary and secondary plug switches. Where two independent circuits are desired for the secondary, provision is made so that they may be switched together. The instrument and switch equipment are standard.

Distribution is accomplished by means of a complete metallic circuit of varnished-cambric cable consisting of No. 8 B. & S. gage stranded copper single conductor. The conductor must, by the requirements, be covered with varnished-cambric insulation at least $\frac{6}{32}$ in (4.8 mm.) in thickness and in addition with a sheath of

pure lead of at least $\frac{1}{16}$ in. (2 mm.) thickness. The lead sheath is served with tarred jute armored with two layers of steel tape wound on spirally, the whole being finally covered with tarred jute and well filled with a preservative compound. The material used for insulation has to comply with the National Board of Fire Underwriters' rulings regarding dielectric, physical, chemical and insulation tests is so far as these apply to the insulation material proposed for use.

For the boulevard posts a single-light standard of reinforced concrete was selected, approximately 12 ft. (3.6 m.) high, with a 1½-in. (3.8-cm.) conduit extending up through the center. The posts are painted white and each is surmounted by a 10-in. by 18-in. (25-cm. by 45-cm.) Alba globe. Series tungsten lamps rated at 400 cp., 6.6 amp., are used. The cable which is installed underground is brought to the bottom of each boulevard post in turn and looped up through the 1½-in. iron conduit pipe to a series receptacle mounted in the top of the post. Before entering the conduit the outer covering of the cable is stripped off down to, but not including, the lead sheath for that portion of the cable which is looped up into the post. About 6 in. (15 cm.) below the series receptacle in the top of the post, the lead sheath is removed from the cable, leaving the wire with only the varnished-cambric insulation. At this point the conductor is spliced to not less than No. 12 B. & S. gage rubber-covered wire, the insulation being equivalent to that of the varnished cambric. In the top of the pipe directly beneath the receptacle is wedged a hard-maple block containing two holes of the proper size and the proper distance apart to permit the wires to extend through it. Before driving in the plug the pipe is filled with oakum down below the top of the lead sheath up to within 1 in. (2.5 cm.) of the top of the lead sheath and packed in such a way as to prevent moisture from entering the sheath of the cable; above this the pipe is filled with Okonite compound completely covering the splice and up to the hard-maple plug. The

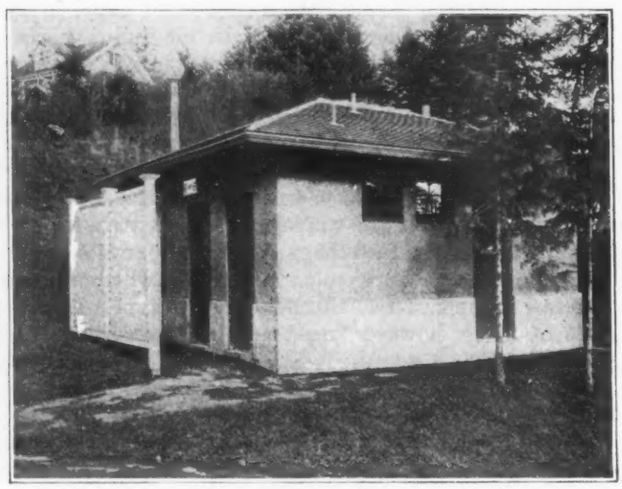


FIG. 1—COMBINATION COMFORT STATION, TOOL HOUSE AND ELECTRIC SUBSTATION

wires extend through the plug and are attached directly to the series receptacle mounted above the pipe.

The first installation under this system consisted of fifty units used in completing Terwilliger Boulevard. A portion of the boulevard which had been completed earlier had already an installation of forty-one units. In this case, however, a multiple system had been installed. The distribution was underground by means of a 2300-volt primary to vaults containing transformers, thence to the lamps by means of a three-wire, 120-240-volt secondary. The lamps used were 400-watt tungsten units, but the posts and globes were identical

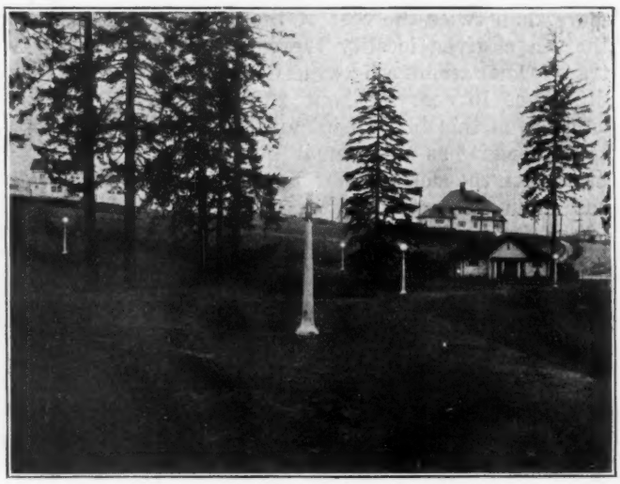


FIG. 2—PARK LIGHTING INSTALLATION, SHOWING STANDARDS AND SUBSTATION

in the two installations. The substation in this case has been so selected that the first installation can eventually be cut over into a series system.

Since the completion of the Terwilliger installation five others have been made as follows: Columbia Park, 31 units; Laurelhurst Park, 50 units; Kenilworth Park, 14 units; Holladay Park, 16 units; Sellwood Park, 23 units, and Mount Tabor Park. All the instalaltions are giving excellent satisfaction and the starting and cutting out of the circuits is handled by the patrolman in the district, who has been taught how to do this even on a constant-current switchboard.

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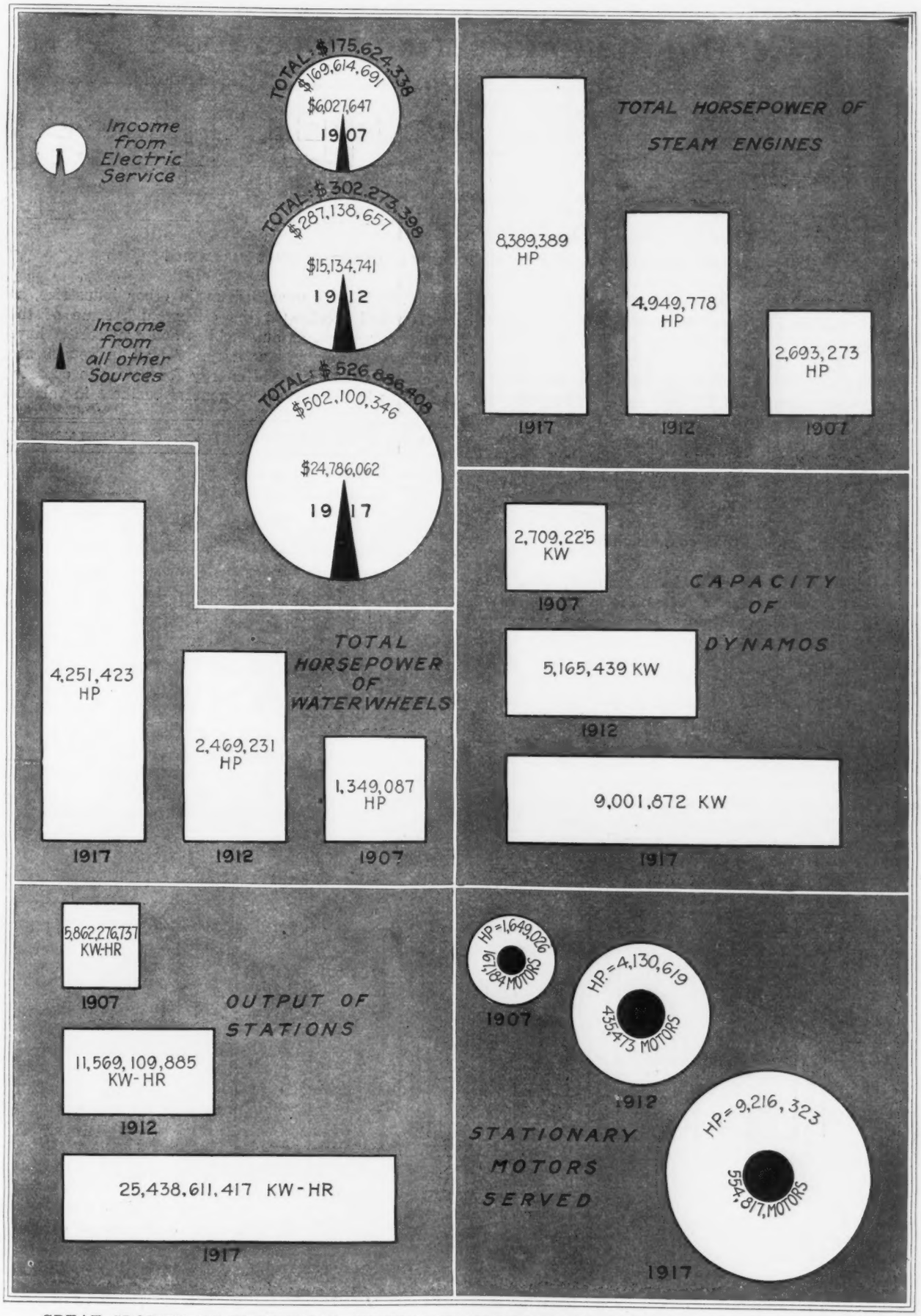
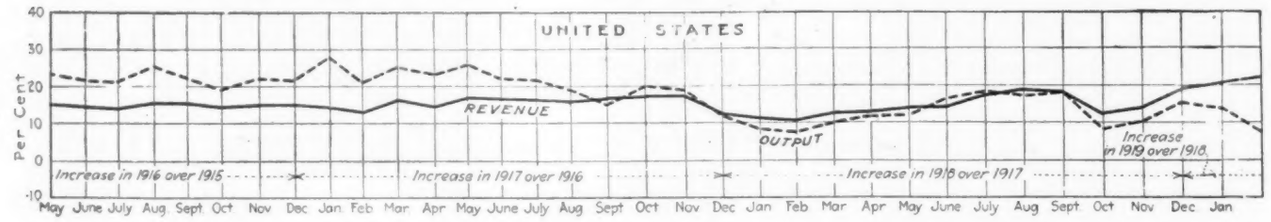
THERE is a feeling on the part of many business men that their competitors, at home as well as abroad, are not playing the game fairly. This is largely imaginary. We hear a great deal these days about what is going to happen to American business when Great Britain and the other nations, supposed to have certain advantages over us, get into full swing. After three months studying the situation in Europe I have not observed any outstanding advantage which they have over us. This is true not merely of manufacturing but with reference even to shipbuilding. Here we find some cloistered critics asserting we will never be able to compete with British shipping. Over in England you will hear English critics telling their government that Great Britain will never be able to compete with us. We should not complain about Great Britain, France and Italy placing temporary restrictions on a number of commodities which they import. They are the best judges concerning what particular products they can do without during the trying economic period which they are going through.—*Edward N. Hurley.*




GREAT GROWTH OF ELECTRICAL CENTRAL-STATION INDUSTRY SHOWN IN THE 1917 CENSUS

# Central Station February Operations


UNITED STATES
Per Cent
40
30
20
10
0
-10
REVENUE
OUTPUT
Increase in 1916 over 1915
Increase in 1917 over 1916
Increase in 1918 over 1917
Increase in 1919 over 1918
May June July Aug Sept Oct Nov Dec Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec Jan

THE INCREASE IN OUTPUT WAS NOTICEABLY LESS THAN THE INCREASE IN REVENUE

CHANGES in business conditions in some cities of the country are reflected in the February returns of central stations to the ELECTRICAL WORLD. While the increase in revenue as compared with February, 1918, is 21.9 per cent, the increase in kilowatt-hour output is 7.7 per cent. The gain in revenue is above the level reported for a number of months. The gain in output of energy is the smallest reported since February of last year, when the increase over February, 1917, was 7.1 per cent. As the statistics presented for February of this year are based on the preliminary returns from 48 per cent of the industry, it is possible that some modification may be made by the fuller returns.

The most striking feature of the February results is the fact that the increase in revenue is so much greater than the increase in output. It was in September, 1917, that the rate of increase in output began to be lower than the rate of increase in revenue. During the year following the curves crossed several times. In October, 1918, the rate of gain in output fell below the rate of gain in revenue, and the tendency thus indicated continued until it became widely extended.

Under present conditions it is difficult to say how much significance is to be attached to the fact that the rate of increase in the output of energy is less than the industry has been accustomed to expect. Sharp recessions have taken place in some industries, as in copper. There is unsettlement in other industries, as in iron and steel. On the other hand, some of the luxury industries, as automobiles and accessories, have taken great spurts in activity. As all industries are dependent upon electrical energy for power to operate, the shifts in the current of general business in various lines of manufacture and in different sections of the country are certain to be reflected in the returns.

From the returns the ELECTRICAL WORLD estimates the results for February for the entire industry as follows: Revenue, $50,510,000; output, 2,158,478,000 kw.-hr.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

| | Percentage of Industry Represented | Revenue from the Sale of Energy | | | Kw.-Hr. Output | | |
|---|---|---|---|---|---|---|---|
| | | 1918 | 1917 | Per Cent Increase | 1918 | 1917 | Per Cent Increase |
| Mar. | 60 | $25,396,000 | $22,702,000 | 12.3 | 1,418,222,000 | 1,294,561,000 | 9.4 |
| Apr. | 60 | 25,864,000 | 22,966,000 | 12.6 | 1,450,221,000 | 1,297,843,000 | 11.5 |
| May | 62 | 25,365,000 | 22,426,000 | 13.1 | 1,537,527,000 | 1,372,935,000 | 11.9 |
| June | 60 | 26,070,000 | 22,599,000 | 15.3 | 1,531,099,000 | 1,319,444,000 | 16.0 |
| July | 56 | 21,935,000 | 18,559,000 | 18.2 | 1,370,461,000 | 1,156,692,000 | 18.5 |
| Aug. | 61 | 26,891,000 | 22,690,000 | 18.5 | 1,647,510,000 | 1,417,150,000 | 16.3 |
| Sept. | 60 | 28,051,000 | 23,810,000 | 17.8 | 1,579,149,000 | 1,348,820,000 | 17.0 |
| Oct. | 56 | 26,254,000 | 23,228,000 | 13.0 | 1,517,866,000 | 1,392,359,000 | 9.0 |
| Nov. | 57 | 29,883,000 | 25,894,000 | 15.4 | 1,528,836,000 | 1,383,747,000 | 10.5 |
| Dec. | 56 | 32,058,000 | 27,128,000 | 18.1 | 1,539,161,000 | 1,369,542,000 | 12.3 |
| | | 1919 | 1918 | | 1919 | 1918 | |
| Jan. | 57 | 33,294,000 | 27,589,000 | 20.6 | 1,522,660,000 | 1,357,460,000 | 12.1 |
| Feb. | 48 | 24,245,000 | 19,884,000 | 21.9 | 1,036,069,000 | 961,633,000 | 7.7 |

From the returns the ELECTRICAL WORLD estimates the results for February for the entire industry as follows: Revenue, $50,510,000; output, 2,158,478,000 kw.-hr.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

| | Month | New England States | | | Atlantic States | | | Central States | | | Pacific and Mountain States | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Percentage of Industry Represented | 1918 | 1917 | Per Cent Increase | Percentage of Industry Represented | 1918 | 1917 | Per Cent Increase | Percentage of Industry Represented | 1918 | 1917 | Per Cent Increase | Percentage of Industry Represented | 1918 | 1917 | Per Cent Increase |
| REVENUE | March | 62 | $2,985,000 | $2,724,000 | 9.2 | 59 | $9,904,000 | $8,922,000 | 11.0 | 53 | $7,947,000 | $6,735,000 | 18.0 | 84 | $4,560,000 | $4,321,000 | 5.5 |
| | April | 62 | 2,890,000 | 2,578,000 | 12.1 | 59 | 10,054,000 | 8,946,000 | 12.4 | 53 | 8,431,000 | 7,103,000 | 18.7 | 84 | 4,489,000 | 4,339,000 | 3.5 |
| | May | 62 | 2,810,000 | 2,530,000 | 11.5 | 64 | 9,929,000 | 8,613,000 | 15.3 | 53 | 8,217,000 | 6,956,000 | 18.1 | 83 | 4,805,000 | 4,327,000 | 12.0 |
| | June | 63 | 2,925,000 | 2,584,000 | 13.3 | 63 | 10,048,000 | 8,761,000 | 14.7 | 49 | 8,124,000 | 6,824,000 | 19.0 | 84 | 4,973,000 | 4,432,000 | 12.2 |
| | July | 62 | 3,037,000 | 2,511,000 | 20.9 | 62 | 9,278,000 | 7,961,000 | 16.5 | 42 | 4,998,000 | 4,116,000 | 21.4 | 88 | 4,622,000 | 3,971,000 | 16.4 |
| | Aug. | 63 | 3,138,000 | 2,585,000 | 21.4 | 63 | 10,147,000 | 8,722,000 | 16.3 | 51 | 8,223,000 | 6,823,000 | 20.5 | 85 | 5,383,000 | 4,560,000 | 18.0 |
| | Sept. | 64 | 3,268,000 | 2,811,000 | 16.2 | 57 | 10,143,000 | 8,631,000 | 17.5 | 51 | 9,251,000 | 7,703,000 | 20.1 | 86 | 5,389,000 | 4,665,000 | 15.5 |
| | Oct. | 63 | 3,360,000 | 3,036,000 | 10.6 | 51 | 8,822,000 | 7,924,000 | 11.3 | 50 | 9,218,000 | 7,848,000 | 17.4 | 81 | 4,854,000 | 4,420,000 | 9.8 |
| | Nov. | 64 | 3,695,000 | 3,238,000 | 14.1 | 55 | 11,877,000 | 10,400,000 | 14.2 | 50 | 9,277,000 | 7,704,000 | 20.4 | 81 | 5,034,000 | 4,552,000 | 10.6 |
| | Dec. | 64 | 4,097,000 | 3,449,000 | 18.7 | 55 | 11,927,000 | 10,199,000 | 16.9 | 50 | 10,781,000 | 8,836,000 | 22.0 | 79 | 5,253,000 | 4,644,000 | 13.1 |
| | | | 1919 | 1918 | | | 1919 | 1918 | | | 1919 | 1918 | | | 1919 | 1918 | |
| | Jan. | 63 | 4,253,000 | 3,443,000 | 23.5 | 60 | 13,444,000 | 11,168,000 | 20.3 | 47 | 10,410,000 | 8,484,000 | 22.7 | 77 | 5,187,000 | 4,494,000 | 15.4 |
| | Feb. | 63 | 3,869,000 | 3,015,000 | 28.3 | 51 | 10,378,000 | 8,540,000 | 21.5 | 29 | 5,976,000 | 4,723,000 | 26.5 | 73 | 4,022,000 | 3,606,000 | 11.5 |
| | | | 1918 | 1917 | | | 1918 | 1917 | | | 1918 | 1917 | | | 1918 | 1917 | |
| KW.-HR. OUTPUT | March | 62 | 121,518,000 | 111,576,000 | 8.9 | 59 | 501,320,000 | 452,250,000 | 10.8 | 53 | 398,166,000 | 356,860,000 | 11.5 | 84 | 397,218,000 | 373,875,000 | 6.2 |
| | April | 62 | 117,416,000 | 101,888,000 | 15.2 | 59 | 497,460,000 | 431,786,000 | 15.2 | 53 | 437,054,000 | 392,304,000 | 11.4 | 84 | 399,126,000 | 372,465,000 | 7.1 |
| | May | 62 | 121,751,000 | 105,601,000 | 15.3 | 64 | 512,202,000 | 455,977,000 | 12.3 | 53 | 441,202,000 | 404,560,000 | 9.0 | 83 | 462,372,000 | 406,797,000 | 13.6 |
| | June | 63 | 125,809,000 | 103,292,000 | 21.8 | 63 | 527,773,000 | 461,396,000 | 14.4 | 49 | 423,439,000 | 366,382,000 | 15.5 | 84 | 454,078,000 | 388,374,000 | 16.9 |
| | July | 62 | 135,960,000 | 105,373,000 | 29.0 | 62 | 518,566,000 | 439,464,000 | 18.0 | 42 | 254,189,000 | 216,296,000 | 17.5 | 88 | 461,746,000 | 395,559,000 | 16.7 |
| | Aug. | 63 | 143,566,000 | 114,017,000 | 25.9 | 63 | 567,672,000 | 490,505,000 | 15.7 | 51 | 447,829,000 | 399,278,000 | 12.1 | 85 | 488,433,000 | 413,350,000 | 18.1 |
| | Sept. | 64 | 133,901,000 | 114,279,000 | 17.1 | 57 | 520,312,000 | 445,154,000 | 16.8 | 51 | 471,594,000 | 408,320,000 | 15.5 | 86 | 453,342,000 | 381,067,000 | 18.9 |
| | Oct. | 63 | 139,784,000 | 128,970,000 | 8.3 | 51 | 481,277,000 | 440,268,000 | 9.3 | 50 | 479,990,000 | 442,054,000 | 8.5 | 81 | 416,870,000 | 381,067,000 | 9.4 |
| | Nov. | 64 | 138,559,000 | 123,033,000 | 12.6 | 55 | 542,699,000 | 495,812,000 | 9.4 | 50 | 444,012,000 | 396,665,000 | 11.9 | 81 | 403,566,000 | 368,237,000 | 9.6 |
| | Dec. | 64 | 145,543,000 | 129,838,000 | 12.1 | 55 | 475,253,000 | 421,973,000 | 12.6 | 50 | 489,864,000 | 443,544,000 | 10.4 | 79 | 428,906,000 | 374,187,000 | 14.6 |
| | | | 1919 | 1918 | | | 1919 | 1918 | | | 1919 | 1918 | | | 1919 | 1918 | |
| | Jan. | 63 | 143,254,000 | 124,637,000 | 14.9 | 60 | 525,322,000 | 458,545,000 | 14.5 | 47 | 463,394,000 | 403,127,000 | 14.9 | 77 | 390,690,000 | 371,156,000 | 5.2 |
| | Feb. | 63 | 126,591,000 | 107,389,000 | 17.8 | 51 | 393,463,000 | 363,618,000 | 8.2 | 29 | 228,754,000 | 197,307,000 | 15.9 | 73 | 287,261,000 | 293,319,000 | 0.2 |

# Rewinding 12,000-Kw. Turbo-Generator Field

## How the Union Electric Light & Power Company, St. Louis, Got a Large Generator Back on the Bus Thirty Days After the Field Broke Down—Detailed Account of the Work Performed on the Insulation and Damaged Coils

HAVING to reinsulate the field windings on one of its generators and not wishing to be without the service of this machine all the time required to ship the field to the factory for repairs and get it back, the Union Electric Light & Power Company of St. Louis made arrangements for doing the work at its plant and thereby got the generator back on the bus thirty days after the field broke down. Since other companies may benefit by doing likewise in some cases, the arrangements made and methods employed will be explained in detail.

To give some idea of the magnitude of the work it may be pointed out that the generator was rated at 12,000 kw., 4500 volts, three-phase, 60 cycles and 720 r.p.m. Tests indicated that the field was grounded, and examination showed that the coils were also damaged. The insulation was so thoroughly dried out and fatigued that it was deemed advisable to reinsulate the field windings throughout. Since fiber paper and oiled linen tape, which were originally used on this machine, were found to carbonize at too low a temperature for this class of service, horn fiber, mica, mica tape and asbestos tape were used instead.

The work of reinsulating a field of this size and construction is practically all manual labor, so two of the manufacturer's expert workmen were obtained from the factory and the necessary clamping presses, tools and insulating material were shipped by express. A temporary repair shop was improvised, consisting of trestles, workbenches, caustic soda tanks, hot-water tanks and receptacles for bolts, laminations, special tools, etc. In the meantime the brass wedges holding in place the blocks of laminations were removed. As each bolt or lamination was taken out it was stamped with a number, and its proper position on the spider was stamped with a corresponding number. The caustic-soda and hot-water tanks, which measured 33 in. by 34 in. by 7.5 ft. (84 cm. by 86 cm. by 2.3 m.) were made of 2-in. (5-cm.) by 12-in. (30-cm.) planks and were held together by planks bolted over the top and under the bottom. Seams were calked and made water-tight, and a 0.75-in. (2-cm.) steam jet was provided for heating. By the second week all of the laminations and coils had been removed from the rotor. The rotor was then carefully cleaned, filed smooth, painted and made ready to receive the coils when reinsulated.

Each coil when removed was heated by passing a current of 700 amp. through it to soften the old varnish and tape. The tape and insulation were then removed, the turns separated, and the entire coil was placed in the tanks containing a strong solution of caustic soda heated with a steam jet. There the parts were allowed to soak for several hours until the old varnish and fiber paper were removed. The solution contained about 100 lb. (45 kg.) caustic soda to 2000 gal. (7570 l.) of water, which was sufficient for the whole job. After the coils were taken out of the tanks they were washed in hot, clean water to remove all traces of the solution and placed on trestles, where they were carefully sandpapered to remove any sediment or burrs on the copper. The burned places between turns were filled with new copper welded on by the oxy-acetylene process.

The next step was to varnish the copper coils with shellac and stick on the between-turn insulation consisting of 0.006-in. (0.15-mm.) asbestos, 0.005-in. (0.125-mm.) mica and 0.0001-in. (0.025-mm.) Japanese paper. After the shellac had been allowed to congeal, the insulation was trimmed to about the width of the copper turns, shellacked on the outside and allowed to dry. As soon as the coils were sufficiently dry to handle wooden screw clamps were attached to hold the coils together and they were transported to the pressing and cementing forms, pressed to the required dimensions and given the proper shape. These forms consisted of sets of inside and outside machined steel blocks set on a sheet-steel body. They were bolted into place to give

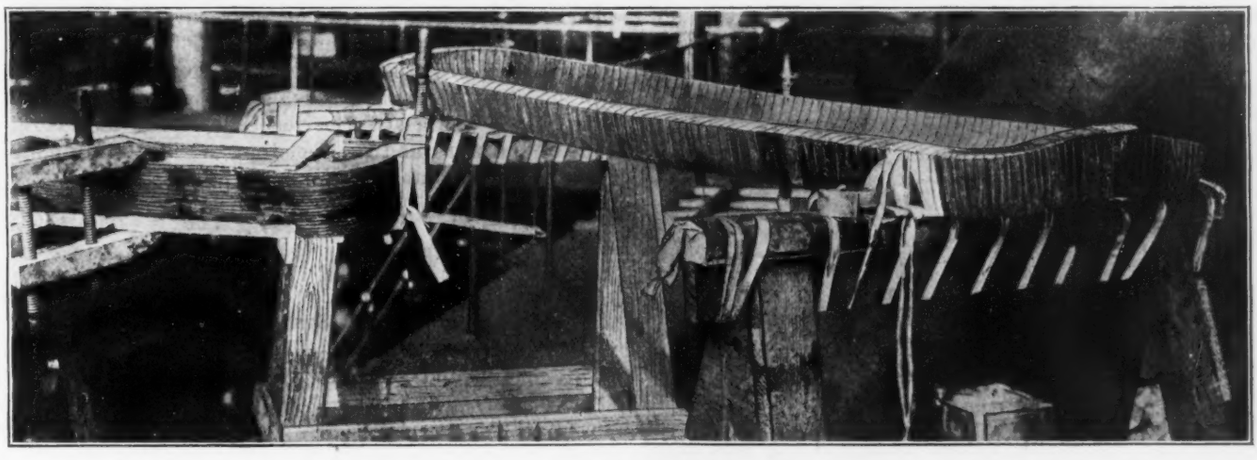


FIG. 1—WORK ON THE DAMAGED COILS IN PROGRESS

The coil to the left has just been removed from the pressing and cementing forms and is ready for the outer insulation; the right-hand coil is in process of insulation with asbestos and mica tape

the coils their finished shape. Studs and U-bolts were used to press the turns together so that when heated by a current of 600 amp. the insulating varnish and shellac cemented them into a solid coil. After the coils had been properly formed and checked for height they were allowed to cool and then taken off the form.

Upon removal from the press each coil was tested for short circuit between turns by passing a current through the whole coil and checking the voltage drop between turns. Each coil was then trimmed of surplus varnish and shellac, the copper connection strips were riveted and soldered in place, and an asbestos strip was pasted over the edges. The coil was then ready for the final taping. The taping process consisted of winding two layers of mica and one of asbestos tape around the straight portions of the coil and around the end portions. One layer of mica and two layers of asbestos tape reinforced with 0.060-in. (15-mm.) mica fillers cut to fit were wrapped around the turns and varnished.

After twenty-four hours' drying over a hot-air grating the coils were replaced in the rotor. The slots had been prepared by lining each with an armor of horn fiber 0.030 in. (7.6 mm.) thick on bottom and sides and 0.060 in. (15.2 mm.) thick on top. The laminations or pole-piece sections, from which all rough sharp edges had been filed, were then placed in the dovetailed slots, one set at a time, and driven into position, where they were wedged by brass pieces. These wedges were driven in to within 0.5 in. (12.7 mm.) of their full length, the remainder being taken up after the coils had all been assembled and heated.

When the coils were all in place and cross-connections between the coils had been made up temporarily the whole field winding was given a high-potential insulation test of 4000 volts for one minute from a 100-kw. testing transformer. The permanent cross-connections were then made and insulated with mica and asbestos tape. Pieces of 0.060-in. (15.2-mm.) mica and 0.005-in. (0.125-mm.) rawhide fiber were fitted over each pole,

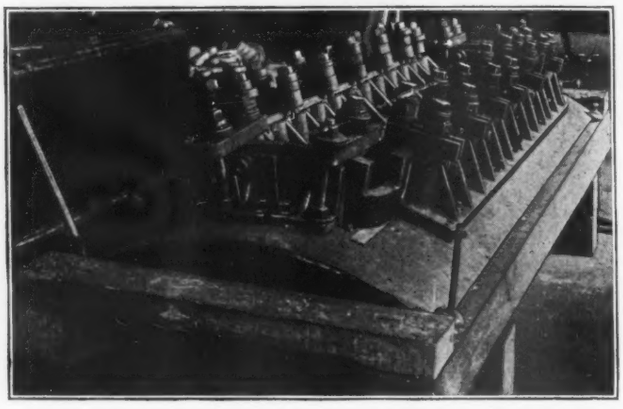


FIG. 2—PRESSING AND CEMENTING FORM, SHOWING A FIELD COIL COMPRESSED TO THE PROPER HEIGHT

after which the ends and the retaining plates were bolted on with the insulated bolts. The coils were again heated to 60 deg. C. and the bolts and wedges tightened and clinched.

A final test of 1500 volts to ground was applied for one and a half minutes when the field was cold. Voltage drops across each pole were compared to see that they balanced. A current of 300 amp. was applied to the finished field for twelve hours, in which period the temperature rose to 50 deg. C.

To assemble the entire field element the trunnions were removed and the lifting bolts fitted up. Then the spider was heated and the completed field fitted on the shaft. The connections from the rotor to the shaft were made, air hood, governor, bearing spider and collector

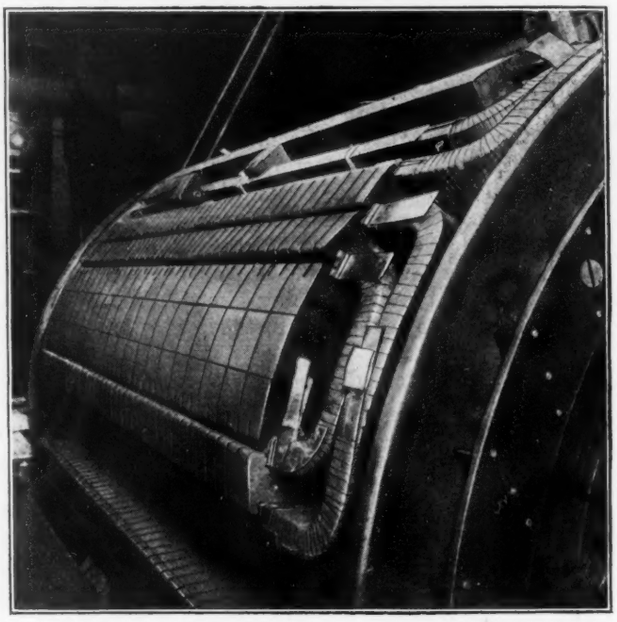


FIG. 3—SOME OF THE COMPLETED COILS MOUNTED IN POSITION ON THE CORE OF THE ROTOR

The pole-piece laminations are driven into position, one riveted section at a time, and clamped with brass wedges to prevent movement.

rings replaced, wiring and piping completed, and the machine was replaced in regular operation.

The repair gang never consisted of more than ten men at any one time, but the job required the services of carpenters, ironworkers, machinists, blacksmiths, electricians, armature winders, laborers and drivers. The machine was out of service 731 hours and 17 minutes, which was a short period considering the magnitude of the work and the fact that the insulating materials had to be obtained from Schenectady, N. Y.

## Modern Bus and Switch Structures

In the issue of April 19 an error occurred in the article "Modern Bus and Switch Structures," by C. D. Gray and M. M. Samuels. The captions with Figs. 6, 7, 8 and 9 should refer to stations of 100,000 kva. instead of 1,000,000 kva. or 1,000,000 kv.

THE National Foreign Trade Council was among the first to see the necessity of making our tariff system more flexible and to advocate the adoption of an adequate bargaining tariff. Desirable as such a measure was before the war, it has now become essential to our commercial development. Our new and influential position in foreign commerce and finance makes imperative a bargaining tariff for the protection of American commercial interests in foreign countries.—*W. S. Culbertson, United State Tariff Commissioner.*

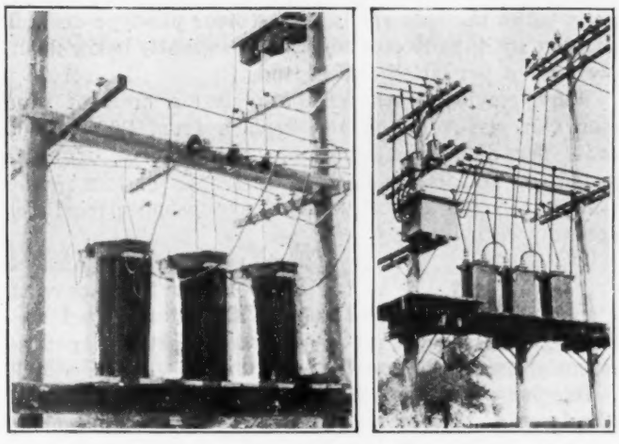
# STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

## POLE SUBSTATION COSTS FOR 13,200 VOLTS OR LESS

### Inexpensive Structures for Supporting Temporary and Permanent Outdoor Transformer Installations Which Serve Small Consumers

The temporary installation of three 50-kva., 2300/13,200-volt transformers shown in the illustration cost, exclusive of transformers, $340 in 1917. The permanent substation, which has the same rating, was installed by the same company at about the same time for



PERMANENT SUBSTATION (RIGHT) COST THREE TIMES AS MUCH AS TEMPORARY STRUCTURE (LEFT)

$1,100. This figure is exclusive of transformers, but it includes a Burke switch and lightning arrester, metering outfit, expulsion fuses, buses, etc. The transformers are mounted about 15 ft. (4.5 m.) above the ground in each case, and the permanent construction illustrated is often used where an inexpensive substation is required to serve a load of about 150 kva. from lines with a potential of not over 13,200 volts.

## OPERATING RESULTS FROM TESTS OF UNIFLOW ENGINE

### 485-hp. Unit of Special Design for Driving Electric Generator and Feeding Steam-Heating System Shows Low Steam Rate

Designed especially for the conditions under which it operates in the plant of the Noblesville (Ind.) Heat, Light & Power Company, a Chuse uniflow engine has shown by acceptance tests that it entirely fills the requirements for which it was made. This engine, which is rated at 485 hp., has two single-acting cylinders placed in tandem with the low-pressure ends together and with metallic packing between them. It is possible to operate the engine with both cylinders discharging into the condenser or with either cylinder discharging into the company's steam-heating system or discharging to atmosphere. This special design was considered desirable in order to get the best efficiencies from the unit, which, under the conditions, drives a 400-kva. generator and also supplies the variable amount of steam required by the steam-heating system. The results of the tests made by the engineers of the Chuse company and the Noblesville company are given in the following table:

| Load: | Steam Consumption (Lb. per Kw.-hr.) Exhausting to Atmosphere | Steam Consumption (Lb. per Kw.-hr.) Operating Condensing |
|---|---|---|
| One-half | 32.30 | 21.22 |
| Full | 29.08 | 21.31 |

## ELECTROSTATIC PRECIPITATION IN THE SMELTING INDUSTRY

### Some Troubles with Remedies—Treatment of Lead Fumes Particularly Advantageous Because of Valuable Elements Recovered

After two years of pleasing results with the Cottrell treater, Charles S. Barnum, general superintendent of the Pennsylvania Smelting Company, has become very optimistic regarding the future of electrostatic precipitation. This attitude was not reached without preliminary difficulties, but these manifested themselves chiefly in the mechanical arrangement of the treater rather than in the electrical end. Some of the faults may be of interest to any one having in view the installation of an electric treater. A few will be cited and the remedies mentioned.

About the first change was to remove the porcelain resistance rods which carried the suspended electrode chains and to suspend the chains from insulated busbars. At the same time the throttling arrangement in the top of the pipes was changed because it was found that the porcelain insulators would not last, since the throttling arrangement did not prevent arcing. Next followed the absolute necessity of some form of rapping device because the precipitated fume clung persistently to both pipes and chains. As the treater had not been designed with this need in view, it required no little ingenuity, together with much labor and time, to devise and install a suitable system of knockers for the pipes and chains. Third, insulators had to be renewed frequently since they are set in the hopper immediately under the bottoms of the pipes, in the direct current of the fumes and in close contact with the precipitated matter in the hoppers, which will frequently take fire to the consequent destruction of the insulators. In later designs of treaters these insulators are placed outside and away from the path of the gases. Another mistake was to have the fumes blown in below the treater pipes, throwing the work of precipitation on the back lines of pipes, By cutting down the speed of the exhaust fan this fault was partially overcome.

Lead blast-furnace fume is particularly easy to clean

by electrostatic precipitation, 95 to 98 per cent clean-up being obtained most of the time except when the capacity of the treater is exceeded. The operating cost is nominal; with the occasional help of an electrician any intelligent workman can soon learn to care for the treater and the apparatus. The energy consumption is small. In the case under notice the amount of high-tension energy consumption varies from 24 kw.-hr. to 70 kw.-hr. in twenty-four hours, depending on whether one or two furnaces are operating and on the condition of the furnace. Adding to this the energy needed for the two small auxiliary motors, it is seen that the total consumption is not large. A high-tension voltage of 60,000 to 70,000 is usually employed. The precipitated fume mixed with a varying percentage of mechanically settled flue dust assays about as follows: Zinc, 9 to 10 per cent; sulphur, 5 to 6 per cent; arsenic, 2 to 4 per cent; antimony, 0.5 to 1 per cent; silver, 1 to 2 oz. per ton (31 to 62 gr. per 0.9 t.); lead, 55 to 60 per cent.

This information was presented before a recent meeting of the American Electrochemical Society.

## PACIFIC COAST PRACTICE IN TESTING INSULATORS

### Conditions Under Which Each Method Is Particularly Applicable—Both Pin and Link Insulators Receive Consideration

Megger, 60-cycle, high-voltage, oscillator, spark-coil and telephone-detector tests are the principal methods of testing insulators used on the Pacific Coast according to the report of the insulation committee of the Pacific Coast Section of the N. E. L. A., of which John A. Koontz, electrical engineer with the Great Western Power Company, is chairman. The applicability and limitation of each method, as determined from analyses made by this committee, are indicated below.

For the megger test a crew of four men, consisting of two linemen, one megger-man and a driver, has been found sufficient. Basing figures on an eight-hour day, they will test from 200 to 700 link insulators per day, depending on the number of insulators used per string, the height of towers or poles and accessibility of lines.

Any good insulator with clean, dry surfaces should have an insulation resistance of from 500,000 megohms to 750,000 megohms, so that if an insulator has reached a resistance value of 2000 megohms or below, it should be discarded, as it is near the end of its useful life.

At times of humid weather conditions it may be necessary to carry two or three good insulators for checks when all insulators give low reading owing to surface moisture. The practice of one large company is to megger all units once every two years, and the places where highest depreciation is occurring once every year.

The series gap should always be used in 60-cycle testing. By observing the color and character of the arc across the gap, porous porcelain can be detected. The reddish glow of the arc in the series gap will indicate porous material, while the arc will have a bluish "snappy" appearance, that of charging current, for good material.

Suspension insulators of the later designs should be subjected to flashover four or five times before acceptance, while the thin shells of the older pin-type designs should only be subjected to a voltage slightly below flash over for a period of five seconds.

When employing the oscillator test a crew of nine men can remove, test and replace from 200 to 600 units per day, depending upon the number of units per string and the strings per tower. Insulators should stand flashover for at least a five-second period for acceptance.

Two linemen, one groundman, one tester and one driver can test 150 to 500 units a day in place with a spark coil. Perfect contacts with the cemented surfaces on both sides of a porcelain part are not so essential as in other methods of testing.

Telephone detector sets are generally used as a shunt circuit on the wood pole to detect leakage current to earth through the pole. The arcing and overstressing of insulator parts give rise to high-frequency currents which will give a distinctive tone in the receiver. By going to the cross-arm it is generally possible to locate the pin or link string in question on wood-pole construction.

DATA ON PACIFIC COAST PRACTICE IN TESTING INSULATORS

| Testing Apparatus | Applicability | Pin Insulators | | | | Link Insulators | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | One-Piece | | Built-Up | | One Unit per String | | More Than One Unit Per String | |
| | | Laboratory Test | Field Test | Laboratory Test | Field Test | Laboratory Test | Field Test | Laboratory Test | Field Test |
| Megger (80 lb.) | Suitable except in extremely wet or dry climates | Can be used | Not suitable | Can be used | Individual parts can be tested but cement must be wetted to get results | Can be used | Not suitable | Can be used | Well adapted |
| 60-cycle high-voltage | Most conclusive test | Well adapted | Not suitable | Well adapted | Suitable extreme case | Well adapted | Suitable extreme case | Well adapted | Suitable extreme case |
| Oscillator (4000 lb.) | Will detect defects away from cap in dry insulators. Will sometimes pass low megohm insulators | Suitable | Not suitable | Suitable | Not suitable | Suitable | Not suitable | Suitable | Not suitable |
| Induction coil (80 lb.) | Results intermediate between oscillator and 60-cycle high voltage. Detects cracks as well as porous insulators | Can be used | Not suitable | Better than megger | Can be used | Can be used | Not suitable | Can be used | Can be used |
| Telephone detector | Will not detect between leakage over dirty insulator | Not suitable | Can be used, limited | Not suitable | Can be used, limited | Not suitable | Can be used, limited | Not suitable | Can be used, limited |

# CENTRAL STATION SERVICE

## A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

### INSTRUMENT FOR RECORDING INTENSITY OF DAYLIGHT

**Employed by Boston Central Station, Based on Discovery that Resistance of Tungsten Lamp Varies with Amount of Daylight**

The amount of daylight throughout the different portions of the year is a matter which is of considerable interest to a corporation furnishing electricity to the public, for the amount and variation of this daylight is reflected to a greater or less degree in the load curve of the company. Occasionally a customer objects to the charge rendered for electricity during the winter

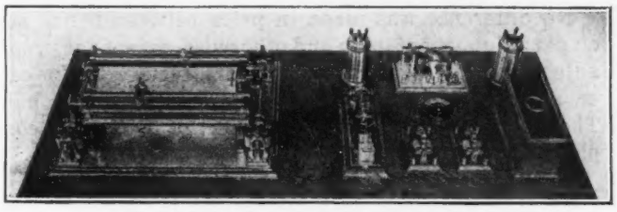


FIG. 1—TOP VIEW OF DAYLIGHT RECORDER

months and bases his objection on the amount of his bill for the corresponding month in the previous year. If the company has data on file showing the percentage of clear and cloudy days for these two months, however, it is possible to show the customer that the increase is due to a period containing many cloudy days which called for an increased use of electricity for illumination during daylight hours.

For the purpose of measuring such changes in daylight and recording them for comparison, F. A. Swan of Boston developed an instrument known as the meteorograph, which consists of two principal parts, the receiver and the recorder. The receiver is installed on the roof of the laboratory of the Boston Edison company in such manner that it is exposed to radiation from all parts of the sky. The recording apparatus is contained in a cabinet in the standardizing laboratory of the company.

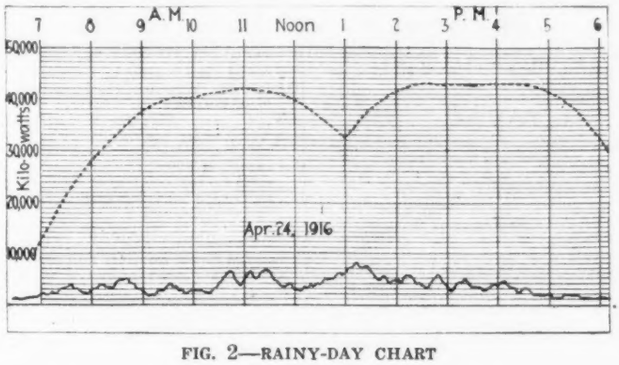



FIG. 2—RAINY-DAY CHART

The device operates on the principle of a Wheatstone bridge. The bridge is in balance when no light falls upon it. The action of light on the receiver throws the bridge out of balance and causes a deflection of the galvanometer. The galvanometer is combined with a relay, and the action of this relay causes a slider to move until the bridge is again in balance. The slider carries with it a pen arm, and by this means a curve is drawn on a chart in accordance with every change of daylight. The accompanying curves show the action of the instrument on a rainy day (Fig. 2) and on a sunny day (Fig. 3).

### NEW MARKETS FOR ENERGY USED IN WAR INDUSTRIES

**Estimated Transformer Capacity of 2,100,000 Kw. Devoted to War Industries in 1919 Now Available Turns Attention to Appliances**

Calling attention to the discontinuance of energy consumption by war industries, the Society for Electrical Development, New York, says that central stations should not overlook the use of electric cooking devices and certain of the more widely used electrical appliances.

While it is difficult to verify the figures, the statement has been made that transformer capacity amounting to 2,120,000 kw. was devoted to war industries in 1918. The distribution, as given by the society, was about as follows: South Atlantic States, 20,000 kw.; New England States, 300,000 kw.; Central West district, 250,000 kw.; Rocky Mountain district, 50,000 kw.; Pacific Coast, 150,000 kw.; New York, 750,000 kw.; Pennsylvania and Maryland, 500,000 kw.; Southwest district, 100,000 kw.; total, 2,120,000 kw.

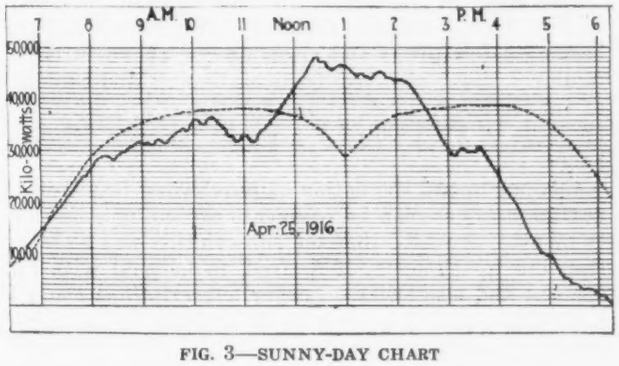



FIG. 3—SUNNY-DAY CHART

It is also recalled by the society that, owing to government restrictions, the high cost of material, labor and so on, very little extension of transmission lines was done during the past eighteen months. To remedy this condition various house-wiring campaigns were inaugurated throughout the country, and the nation-wide society movement, "Electrify your home," was carried on.

## POSITION OF UTILITIES APPLIANCE SALES IN MARKET

### Figures Showing Sales During 1918 of Utah Central-Station Company and of Dealers Doing Business in Territory

Some interesting figures showing the relative part played by the central station and other retail distributers in the market for appliances were given by T. W. Simpson, Western district manager of the Federal Sign System (Electric), before the Pacific Coast Section of the National Electric Light Association. These figures, which are given in the table, are for the Utah Power & Light Company, which serves a territory of 50,888 residence consumers. The table shows the totals in numbers of articles sold during 1918 by the company and the estimated sales of dealers during that period.

ARTICLES SOLD IN TERRITORY OF UTAH COMPANY, 1918

| Total | Sold by Central Station | Sold by Dealers | Sold by Both Dealers and Central Station | Number of Articles in Use on Line |
|---|---|---|---|---|
| Lamps | 156,000 | 226,000 | 382,000 | ..... |
| Ranges | 679 | None | 679 | 2,396 |
| Grills and disks | 1,462 | 950 | 2,412 | 11,536 |
| Water heaters | 224 | few | 224 | 750 |
| Percolators | 405 | 300 | 705 | 1,560 |
| Fans | 309 | 300 | 609 | 3,500 |
| Irons | 3,741 | 2,500 | 6,241 | 56,934 |
| Washing machines | 1,708 | 1,700 | 3,408 | 11,265 |
| Cleaners | 956 | 1,000 | 1,956 | 4,469 |
| Other appliances | 2,497 | 2,000 | 4,497 | 8,500 |
| Signs* | 31 | 10 | 41 | 1,122 |
| Window reflectors | 857 | 1,500 | 2,357 | ..... |

* Lightless nights and steel restrictions in 1918 affected this item adversely.

## POPULAR SUBSCRIPTION TO $750,000 BONDS IN TWO WEEKS

### New York Property Serving a Few Small Communities Gets More than 1000 Subscriptions for $1,000 or Less

In a space of two weeks, the time allotted, the Central Hudson Gas & Electric Company, Poughkeepsie, N. Y., serving a few towns and cities no one of which is particularly large, received from customers and residents of its territory subscriptions for the entire amount of an issue of $750,000 of 7 per cent ten-year debenture bonds.

Customers had the option of purchasing bonds on the partial-payment plan by payments extending over twenty months, provided that the subscription was $2,000 or less, the installments, if desired, to be paid with bills for gas and electricity. Larger subscriptions could be paid either in full or half down and the remainder by April 15 last.

Letters were sent out to all customers and were followed up by advertisements in the local papers and by personal calls by regular company employees on virtually every customer.

The first letter was sent out on Feb. 24 and, in addition to stating the terms, said:

We believe that every opportunity should be given to our customers to purchase the company's securities instead of selling them to brokers for distribution outside of the company's field of operation. These securities are to provide new capital for additions and extensions to take care of the increasing demands of the territory. They represent a favorable opportunity for investment, created by the rapid growth of the business, and we believe that it is of advantage to the company as well as to its patrons to have the company's securities owned in communities it serves for the following reasons:

First—To make the public and the company financial partners in an enterprise which is essential for community advancement.

Second—To provide investment for the surplus capital and savings of citizens in a safe business which they have under their personal observation.

Third—To increase the prosperity of the territory by distributing earnings locally.

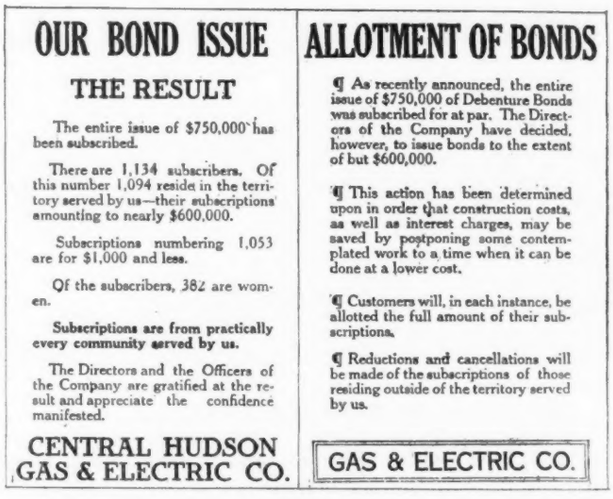
On March 13, three days after the campaign closed, the company announced by advertisement that the response had been very gratifying, stating that the tabulated result would be announced later. This came on March 19, showing that the entire issue was subscribed by 1134 persons, of whom 1094 reside in the company's territory, their subscriptions amounting to nearly $600,000. Subscriptions numbering 1053 were for $1,000 and less. Of the subscribers 382 were women. On March 22 the company announced, as shown, that only $600,000 would be allotted, but that customers would be allotted the full amount of their subscriptions.

No difference was made in price between bonds sold on partial-payment plan and otherwise, except for proper adjustment of interest. Customers receive 7 per cent on all cash paid the company from the time it is paid. The bonds are held as collateral until payments are completed.

In answer to the question of how much was saved by marketing securities in this way, L. H. Scherch, commercial manager of the company, who handled the publicity and directed the sale of the bonds, said:

We do not place the securities on the market primarily with the idea of effecting a saving, but because we believe that utilities should be financed by their patrons and everything should be done to encourage customers becoming partners in the enterprise. The cost of marketing securities in the way we did is very small and involves simply the newspaper advertising and circularizing, to which, of course, should be added the solicitation, but this was entirely by our own organization. No bonus was offered to salesmen, but several prizes were offered to those employees who obtained the most subscriptions.

Customers will be billed for the partial payments on regular gas and electric bills in the place provided for merchandise.



**OUR BOND ISSUE**

**THE RESULT**

The entire issue of $750,000 has been subscribed.

There are 1,134 subscribers. Of this number 1,094 reside in the territory served by us—their subscriptions amounting to nearly $600,000.

Subscriptions numbering 1,053 are for $1,000 and less.

Of the subscribers, 382 are women.

**Subscriptions are from practically every community served by us.**

The Directors and the Officers of the Company are gratified at the result and appreciate the confidence manifested.

**CENTRAL HUDSON GAS & ELECTRIC CO.**

**ALLOTMENT OF BONDS**

¶ As recently announced, the entire issue of $750,000 of Debenture Bonds was subscribed for at par. The Directors of the Company have decided, however, to issue bonds to the extent of but $600,000.

¶ This action has been determined upon in order that construction costs, as well as interest charges, may be saved by postponing some contemplated work to a time when it can be done at a lower cost.

¶ Customers will, in each instance, be allotted the full amount of their subscriptions.

¶ Reductions and cancellations will be made of the subscriptions of those residing outside of the territory served by us.

**GAS & ELECTRIC CO.**

ADVERTISEMENT ANNOUNCING RESULT OF BOND ISSUE

# TECHNICAL THEORY & PRACTICE

## Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

### Generators, Motors and Transformers

*Influence of Distribution Losses on Efficiency Curves of Continuous-Current Motor.*—THOMAS CARTER.—In this number of the series the writer discusses the maximum output which can be obtained from a motor and the values of input and efficiency at which it occurs. He also gives the direction relation between input and output.—London *Electrician*, March 7, 1919.

*Parallel Running of Alternators.*—DE MARCHENA.—The object of the article is to show how to apply the known theories on the parallel running of alternators to special cases. The investigation was suggested by the instability of running met with in the case of certain generating sets driven by gas engines that were installed at the generating station at La Rochelle. After stating the general theory, numerical applications are made showing how to estimate the danger of hunting, and figures are given for the usual free periods of oscillation of various types of alternators, the range of the frequency of the impressed oscillations produced by various types of engines and the weight of flywheel per horsepower required for stable running.—*Technical Supplement to Review of Foreign Press.* (Abstracted from *Bulletin* of Société Française des Electriciens, January, 1919.)

*New Extra-High-Tension Transformer.*—E. WELTER.—The ordinary high-tension transformer is called upon to effect a certain transformation of pressure and to withstand the resultant dielectric stresses. In the new system one transformer provides for pressure transformation and the other deals simply with the dielectric stress. Dessauer's investigations of the new and old systems of connection are summarized. The elimination of brush discharge renders the new transformer safe at even the highest voltages. The new transformer is considered to be of very great importance in connection with the development of high voltages and relatively low power for such purposes as deep therapeutic treatment, testing, dust and smoke precipitation and other electrostatic applications. Voltages from 100 kv. to 200 kv. or higher can be developed safely in compact apparatus.—*Science Abstracts, Section B*, Jan. 31, 1919. (Abstracted from *Elektrot. Zeits.*, Sept. 19 and Sept. 26, 1918.)

### Lamps and Lighting

*Neon Lamps for Direct Current.*—F. SCHROTER.—Neon is a suitable gas for glow-discharge lamps because of its low dielectric cohesion of 5.6 (air 419). The chief spectrum lines lie in the yellow and orange red. In tubes of 50-mm. diameter the potential gradient is 1 volt per centimeter. The glow is exceedingly sensitive to very slight impurities of the neon, however, which is purified after Gehlhoff, and it is very essential that all gases be expelled from the electrodes and lamp walls before sealing off. The author discusses this question with special respect to the cathode metal (mercury—the alkali amalgams of Skaupy). He uses anodes of sheet iron and cathodes of an alloy of cadmium and thallium, melting a little above 200 deg. C. The bulb gas is commercial neon containing 25 per cent helium; higher helium percentages are undesirable. The helium turns the glow tint into pink. When the neon-lamp tube is bent to a nearly closed ring it gives 1.7 hefner candle (spherical) and 2 (horizontal) per watt up to 400 hefner candles with currents of 1 amp. at 220 volts. A small device is needed to start the ionization. It consists of a self-induction coil, a vacuum interrupter and an iron-wire resistor. The lamps last a few thousand hours and do not become hard by occlusion of the neon. The alternating-current lamps will be of different, not yet settled construction.—*Science Abstracts, Section B*, February, 1919. (Abstracted from *Zeits. Elektrochem.*, May 1, 1918.)

### Generation, Transmission and Distribution

*Effective Resistance, Impedance, Self-Induction and Power Losses in an Armored Cable.*—R. BOUZON.—A brief article showing that the effective resistance, the impedance and the self-induction in a monophase steel-armored cable vary in intensity with the magnetization of the steel and cease when saturation is attained. This fact is used to effect a separation between losses by hysteresis and losses by Foucault currents and the Kelvin effect.—*Revue Générale de l'Electricité*, March 15, 1919.

*Transmission of Electrical Energy to the American Arsenal at Beauvoir.*—MICHEL BERTHON.—When the American army began to arrive in France an arsenal for the production and repair of war material was established at Beauvoir, in the Arrondissement of Bourges, and the problem of furnishing electrical energy to it arose. The plan of building a power house having been rejected, it was decided to connect the arsenal with the central station at Mazières, which already supplied important military establishments at Bourges. The American arsenal, designed for more than 6000 workmen, the buildings covering 25 hectares (62 acres), demanded an initial supply of 500 kw., which was to have risen to 7500 kw. before the end of 1919. This article gives a description of the installation and the transmission line, especial attention being paid to the outdoor substation, built after the American plan, where three-phase, 5000-volt energy was transformed to 30,000 volts for transmission 16 km. over copper cables of 60 sq.mm. section to the arsenal, where it was stepped down to 2300 volts and finally to 110, 220 or 240 volts for power and lighting.—*Revue Générale de l'Electricité*, March 22, 1919.

### Traction

*Railway Electrification in Washington.*—About July 1 of this year the Chicago, Milwaukee & St. Paul Rail-

way will begin operating its trains electrically through the Cascade Mountains. The electrification covers 218 miles (350 km.) between Othello, in eastern Washington, and Seattle and Tacoma. Electrical energy is to be supplied by the Washington Water Power Company on the east over a 110,000-volt transmission line from the Long Lake hydroelectric station and from the Snoqualmie plant of the Puget Sound Traction, Light & Power Company, also over a 110,000-volt line on the west. There are substations at Tacoma, Renton, Cedar Falls, Hyak, Cle Elum, Kittitas, Doris and Taunton. Details of the substation and transmission-line equipment are given in this article, and it may be noted that the trolley voltage is to be 3000 volts direct current, as in the case of the Montana-Idaho electrification on this system. When this electrification work is completed the company will have 660 miles (1060 km.) of trunk line electrified in the Northwest.—*Journal of Electricity*, April 1, 1919.

*Selection of Apparatus for Railway Converter Substations.*—C. F. LLOYD.—Features governing choice of types of equipment for direct-current railway substations are outlined. The writer also goes over the factors which must be considered in the design of the building. —*Electrical Review*, April 5. 1919.

*General Discussion on Joining Metals.*—E. WANAMAKER and H. R. PENNINGTON.—Pressure welding, resistance welding, thermit welding, gas welding, electric arc welding and the electric arc are discussed in this paper, which relates particularly to joining metals in railway work.—*Railway Electrical Engineer*, March, 1919.

### Installations, Systems and Appliances

*Electric Welding and Welding Appliances.*—In the fifth number of a series on the subject of electric welding resistance welding machines made under the Pontelec welding patents are described. Although the service is severe inasmuch as the load is intermittently thrown off and on several times per minute and the power factor is about 0.6, the machines answer the purposes very well.—London *Engineer*, March 14, 1919.

*Electricity in Household Service; Heating and Cooking.*—GEORGE A. HUGHES.—The development of heating and cooking applications is discussed. Domestic electric heating appliances in use in the United States are estimated as follows:

| | | | |
|---|---|---|---|
| Grills | 150,000 | Percolators | 150,000 |
| Heating pads | 90,000 | Chafing dishes | 40,000 |
| Teapots | 10,000 | Disks | 250,000 |
| Heaters and radiators | 250,000 | Ranges and hot plates | 50,000 |
| Irons | 4,000,000 | Water heaters | 35,000 |
| Toasters | 480,000 | Miscellaneous | 25,000 |

This is a total of 5,530,000. After discussing the relative advantages of electric cooking and heating devices, the writer points out the immense development that may be expected in the use of such devices along with the extension of the central-station business.—*General Electric Review*, March, 1919.

*Melting Brass in the Induction Furnace.*—G. H. CLAMER.—Discusses the general principles of the induction furnace and describes in detail the Ajax-Wyatt type. This furnace employs a closed channel with a pool above and circulation of the liquid metal in the channel. Brass (60/40) may be melted without volatilization of Zn in the channels of the secondary circuit so long as the cold metal is being fed into the furnace or the bath has not in entirety reached the volatilized point of Zn. In charging it is necessary to guard against bridging of the charge. Constant energetic automatic circulation results from the motor effect, pinch effect and Joule effect. The power factors of 30-kw. and 60-kw. furnaces are 85 per cent and 72 per cent respectively. These furnaces operate on single-phase circuit, 220 volts, 60 cycles. The furnace as developed is intended only for Cu-Zn alloys containing no more than 3 per cent Pb.—*Chemical Abstracts*, March 10, 1919.

### Wires, Wiring and Conduits

*Substitutes for Rubber-Insulated Wires.*—R. NAGEL. —The author describes tests made on various "war wires," particularly in respect of mechanical strength and resistance to moisture and heat. The insulation on the wires investigated consisted of regenerated rubber, bitumen or a series of layers of impregnated paper strip wound on spirally. The last-named system of insulation gives particularly good results, equal in fact to the results given by the best pre-war rubber-insulated conductors. Compared with the latter, paper insulation does not "age" appreciably; it is less affected by prolonged heating and has great uniformity of quality. The substitutional insulations considered do not involve the use of imported raw materials, and it is considered that they may continue to be used after the war. Tests of this wire showed excellent uniformity. The wires insulated by bituminous "substitutes" became quite eccentric with the insulation after twenty hours at 50 deg. C. Regenerated rubber is less objectionable in this respect. Paper insulation is unaffected mechanically and loses only 20 per cent breakdown strength at 75 deg. C., as compared with 39 per cent in regenerated rubber and 73 or 74 per cent in bituminous insulation.—*Science Abstracts, Section B*, February, 1919. (Abstracted from *Elektrot. Zeits.*, Oct. 31, 1918.)

*Stresses in Wire Rope.*—SHORTRIDGE HARDESTY.—The development of a new formula for the determination of bending stresses in wire rope.—*Journal A. S. M. E.*, March, 1919.

### Electrophysics and Magnetism

*Glasses for Protecting the Eyes from Injurious Radiations.*—W. W. COBLENTZ and W. B. EMERSON.—The object of the paper is to give the general characteristics of certain newly developed glasses sometimes used for protecting the eye from radiant energy, especially the infra-red or so-called heat rays. For shielding the eye from infra-red rays, deep-black, yellowish-green, sage-green, gold-plated and bluish-green glasses are the most serviceable. Data are given showing that of the infra-red rays emitted by a furnace heated to 1000 deg. to 1100 deg. C., (1) about 99 per cent are obstructed by gold-plated glasses, (2) about 95 per cent by sage-green or bluish-green glasses, (3) about 60 to 80 per cent by very deep-black glasses, and (4) about 60 per cent by greenish-yellow glasses. For protecting the eye from ultra-violet light, black, amber, green, greenish-yellow and red glasses are efficient. Tabulated data are given also of the transmission of the radiation from the quartz mercury-vapor lamps, the magnetic arc and the gas-filled tungsten lamp through various glasses.—*Technical Paper No. 93*, Bureau of Standards, 1919.

*Dielectrics in Electric Fields.*—This article consists of a summary of three lectures given by G. L. Addenbrooke of which no copies were available. Mr. Addenbrooke dealt with the variations of current and power

factor as a dielectric approaches breakdown in an electric field. The current flowing has a true capacity component, the energy of which is returned to the circuit with each reversal, and a power component, which seems to be wholly converted into heat. There does not appear to be any chemical action. As the temperature rises the dielectric losses increase, whether the dielectric is heated by external means or by alternating stresses set up by the field. Thus the power factor rises up to the point of breakdown. The presence of water has a great effect in increasing the losses, and the author asserts that the dielectric losses appear to be wholly due to moisture and that if perfect dryness could be obtained the dielectric loss would vanish. Many experiments were made with celluloid and glass.—London *Electrician*, March 28, 1919.

### Electrochemistry and Batteries

*Nickel-Plating Cast or Sheet Aluminum.*—After cleaning, polishing, etc., the aluminum is plated at 3 volts to 3½ volts in a solution containing: Water, 3791 g.; $NiSO_4 7H_2O$, 284 g.; $NiSO_4(NH_4)_2SO_4 6H_2O$, 56.7 g.; $MgSO_4 7H_2O$, 56.7 g., and $H_3BO_3$, 56.7 g. A double-throw switch is used, whereby the aluminum articles are momentarily made the anode and the oxide film is dissolved. Then, reversing the switch, the articles become the cathode and nickel is deposited. Contamination of the acid dip or deoxidizing solution with copper is prevented by the use of soft iron for stringing purposes. This also maintains the Fe necessary in the dip. After nickel plating, aluminum articles may be plated in any cyanide bath for brass, copper, silver or gold.—*Chemical Abstracts*, March 10, 1919.

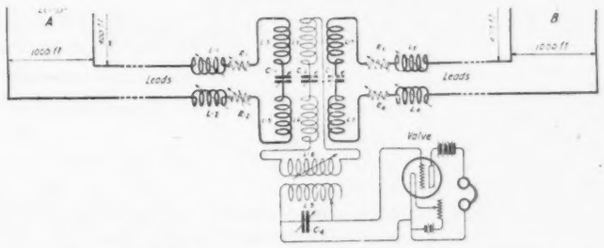
*Making Electric Furnace Bottoms.*—A. W. LORENZ.—The refractory mixture used for the bottom should be rammed well in layers an inch thick. FeO should be kept down, as this is reduced to Fe by the coke, thus diminishing the strength of the bottom. It is probable that to secure the best results a basic electric furnace bottom should contain as little oxidizing material as possible and should be burned in thoroughly with non-reducing flame.—*Chemical Abstracts*, March 10, 1919.

### Units, Measurements and Instruments

*Substitute Materials in Electricity Meters.*—New regulations have been issued in Germany relating to the use of substitute materials in electricity meters. Series coils of alternating-current meters up to 5 amp. are to be made of zinc or aluminum; up to 30 amp. aluminum may be used, and above 30 amp., copper. In direct-current meters the series of coils are to be of aluminum up to 20 amp. and may be of copper above this current. The shunt-circuit armature winding of direct-current meters and the shunt coils in alternating-current meters must be made of copper. Magnets may be made of tungsten steel instead of chrome steel. Terminals for currents up to 30 amp. may not be of substitute metals. For currents from 30 amp. to 100 amp. brass may be used, and copper for higher currents.—*Technical Supplement to Review of Foreign Press.* (Abstracted from *Elektrot. Zeits.*, Jan. 9, 1919.)

### Telegraphy, Telephony and Signals

*Weagant's Anti-Static Invention.*—ELMER E. BUCHER.—Up to the time of Roy A. Weagant's discovery of the nature of static interference, there existed no definite idea of the directions from which this interfering field came. Early efforts to eliminate the static disturbances in wireless transmission of signals were therefore unsuccessful. Upon finding, however, that such static disturbances were vertical in direction, it was not long before Mr. Weagant successfully developed apparatus to shut out static interference. The principle of the apparatus developed for the elimination of static interference is best understood from the diagrams. Here two equal closed circuit loops *L*-1 and *L*-2, are shown coupled to a common secondary *L*-3 of the receiving apparatus application. The vertically propagated static waves are indicated by the downward arrows above the loops, and the advancing signal wave is seen to pass from left to right as shown by the arrows *AA*. Since




STATIC WAVES ARE BLOTTED OUT WHEREAS SIGNAL WAVES COMBINE

the static waves are propagated vertically, they act on loops *A* and *B* simultaneously and generate in them emfs. of equal intensity, which when opposed in the secondary *L*-3 result in zero current and thus blot out the static interference. If the two antennas are spaced one-half wave length from center to center, the emfs. generated in *L*-3 of the signal currents will be in phase, and the resultant will be the arithmetical sum of these two emfs. It is not essential that the effective spacing of the loops be one-half wave length, for one antenna can be employed for a considerable range of wave lengths, provided it is possible to sacrifice part of the signal current. It is thus evident that the signal current may be received through this apparatus, but that no disturbance in the receiving system results from static waves spreading the loops. The discovery opens up the possibility of very important performances.—*Wireless Age*, April, 1919.

### Miscellaneous

*The Liberal Element in Engineering Education.*—GEORGE F. SWAIN.—The author believes that the motto for the future in education should be to make the instruction practical, useful, well within the comprehension of the students and the field of their experience and to motivate it.—*Engineering Education* (Bulletin of the Society for the Promotion of Engineering Education), December, 1918.

*Continental Wireless Telegraphy.*—An article on the use of wireless telegraphy for communicating between Continental countries. The Telefunken and Marconi systems cannot be used for this purpose on account of the kind of waves emitted by them. The writer points out, however, that two other systems exist, known as the "high-frequency" and the "arc-light" systems, which have the advantage that two stations at a distance of 200 km. from each other can reach a third one at a distance of 200 km. without interfering with each other, in spite of the fact that the two former stations are distant from each other by only one-tenth of their wave reach. —*Technical Supplement to Review of Foreign Press.* (Abstracted from *Weltwirtschaftszeitung*, Feb. 7, 1919.)

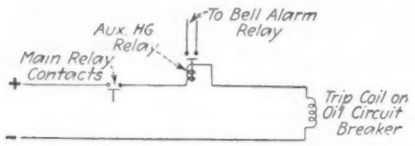
# Readers' Views and Comments

## Bell-Alarm Protection

*To the Editor of* ELECTRICAL WORLD:

SIR: In a letter to the editor published in the ELECTRICAL WORLD of Feb. 22, 1919, there appear several statements in regard to the recommendations of the General Electric Company in connection with protection by means of bell alarms.

*Bell Alarm for Electrically Operated Oil Circuit Breakers.*—The authors of the letter just referred to state that it is practically impossible to obtain extra contacts on the induction-type relay. We wish to thank them for calling attention to the fact that it is not possible actually to get these extra




WIRING SCHEME FOR BELL-ALARM RELAY

contacts self-contained on the relays themselves. The writer is accustomed to thinking of the auxiliary relay (as illustrated in the attached sketch) as an extra contact device of the main relay, and he had this in mind when his original comments were made. As a matter of fact this same relay, known as the type HG, is included within the case of some of the induction-type relays and serves to relieve the primary contacts. If an extra contact is desired, an extra type HG relay is used and mounted outside of the case. In the instantaneous plunger-type relay the extra contact is actually self-contained on the relay itself.

In any event the general comparison of the two schemes for bell alarm remains the same, namely, the simple and inexpensive two-circuit contact arrangement (whether self-contained in the relay or whether a one-circuit contact relay and an auxiliary relay as shown in the sketch), as against the troublesome and expensive passing contact auxiliary switch. In the former scheme one contact is connected to trip the breaker and the other to energize the bell-alarm relay. In the latter scheme a passing contact auxiliary switch on the oil circuit breaker temporarily energizes the bell-alarm relay while the breaker opens. In each of these cases the bell-alarm relay is reset by hand.

*Bell-Alarm Air Circuit Breakers.*—The authors of the letter state indirectly that the General Electric Company does not recommend the automatic reset bell-alarm switch with manually operated air circuit breakers. The following extract from Volume 3, Section 47,500, of the "Switchboard Apparatus Handbook" will be of interest in this connection:

"Where a bell alarm is desired with resetting device on a circuit where no lever switch is connected in series with the circuit breaker, the circuit-closing switch as illustrated is recommended. The construction of this switch is such that it may be opened by hand after the breaker opens, thus interrupting the bell circuit. It is automatically reset when the breaker is closed."

E. H. BECKERT,
Switchboard Department, General Electric Company, Schenectady, N. Y.

## Economical Circuits for Central Stations

*To the Editor of* ELECTRICAL WORLD:

SIR: In articles published in the ELECTRICAL WORLD on May 25, 1918, and March 8, 1919, by P. O. Reyneau, on "Determination of Economical Power Circuits," the equivalent hours were derived to be 9.69 hours for the average industrial power circuit. The equivalent hours are defined as the number of hours per day in which the maximum load would produce the same copper loss as the actual load produces in the entire twenty-four hours. In the first article it was stated that 9.69 hours "represent an average obtained from the study of actual conditions and should be applicable to such circuits in many localities with a fair chance of accuracy."

Upon study of the method used in deriving the 9.69 equivalent hours, it is found that it is correct only when the maximum daily load is constant throughout the year. The following formula is taken from the article of May 25, 1918: "$t_e = (\Sigma I^2) / (I^2_m)$, where $t_e$ = equivalent hours, $I$ = average current for each hour, $I_m$ = maximum current for the day." This formula gives the equivalent hours for one day, but as each is based on a different maximum load (unless the maximum is constant for every day) it is impossible to average the equivalent hours for the entire year.

Furthermore, in the formula for the copper loss of the circuit the value taken for "$I$ is the maximum (yearly) current carried." The only method to determine $t_e$ correctly for substitution in the copper-loss formula is based upon the yearly maximum current. Therefore $I_m$ in the formula quoted above should be equal to the maximum current for the year and not the maximum current for the day.

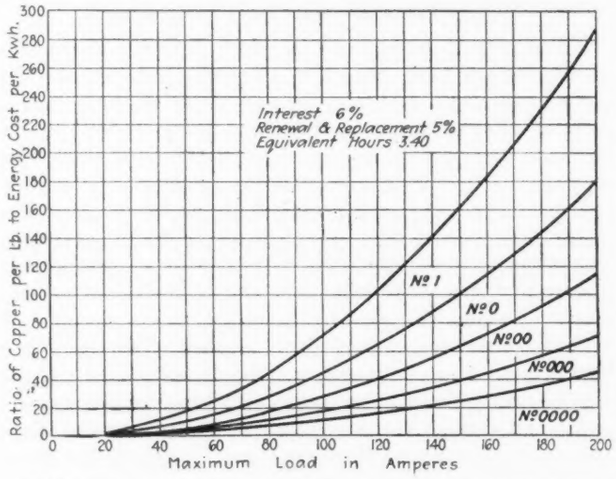
Further, it is to be noted that the average equivalent hours are derived directly from two average days each month and the calculations of copper loss based upon 300 days. This assumes that the load every day for the month is the same as the average, without any consideration of the fact that Saturday is usually but a half day for power load.

An investigation has been made covering sixteen central-station circuits supplying chiefly power, but also supplying a little lighting, as will be found on almost all central-station circuits. The average equivalent hours for these circuits were found to be 3.40 hours, which was determined in the following manner, based upon the annual maximum load:

A representative day was selected for each month and the equivalent hours were obtained for each circuit. Periods of one week were then selected, and the equivalent hours for every circuit for each day were calculated. In this way the ratio between the hours for the average day and the hours throughout the entire week was obtained. This will vary with the type of industry supplied and with the sixteen circuits varied from 81 per cent to 91 per cent.

By means of the above ratio the average hours for each circuit, based on 365 days, were obtained, and as the maximum load on all circuits was approximately the same, the equivalent hours of all circuits were obtained by averaging the equivalent hours of the individual circuits in proportion to their maximum loads.

The curve shown in the figure has been prepared using an average equivalent hours of 3.40, and it shows results far different from those shown in the articles referred to. This curve represents much more usual conditions, but as other companies may find their load conditions of a different character, it is advisable to investigate the actual conditions before determining the most economical size of wire to be used.




MOST ECONOMICAL SIZE OF DISTRIBUTION LINE CONDUCTORS

W. F. BUTCHER,
Assistant Engineer, New York & Queens Electric Light & Power Co.

# NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

## PACIFIC COAST HOLDS ITS THIRD JOINT CONVENTION

**Central Stations, Jobbers and Contractors and Dealers Meet in Coronado, Cal., to "Develop Co-operation and the Spirit of Harmony"**

For the third time practically all branches of the electrical industry on the Pacific Coast are holding a joint annual convention. A combined registration of about 400 was reported on Wednesday of this week, the first day of the joint sessions which are being held at Coronado, Cal. The organizations included are the Pacific Coast Section of the National Electric Light Association, the Pacific division of the Electrical Supply Jobbers' Association and the California Association of Electrical Contractors and Dealers.

The purpose of the joint meetings is primarily to "develop coöperation and the spirit of harmony" and secondarily to exchange experience on problems common to all branches of the industry.

The jobbers' sessions held on the the first two days of the week included, besides the usual golf tournament, papers by D. C. Pence, Illinois Electric Company, on "Competition Based on Vindictiveness"; W. S. Berry, Western Electric Company, on "Service on Returned Goods," and H. L. Harper, Western Electric Company, on "Relations Between Contractor, Jobber and Manufacturer."

The contractors' meetings began on Tuesday, and on Wednesday the National Electric Light Association held its opening meeting. At the latter an address of welcome was made by William Clayton, managing director for the Spreckles properties, and Albert H. Elliott, secretary of the jobbers' association, replied for the convention.

There followed the address of Samuel Kahn, Western States Gas & Electric Company, president of the association, and the reports of officers and chairmen of the various committees.

Even on this first day of the convention it was apparent that team work would be the keynote of the gathering and that earnest endeavor would be made toward furthering the general good of the industry. Samuel Chase, Westinghouse Electric & Manufacturing Company, and W. L. Goodwin, General Electric Company, demonstrated by their coöperative endeavors how rival companies could work together. Practically all of the jobbers, representing about twenty jobbing houses, remained for the joint meetings, which were divided into three classes, commercial, engineering and general or combined sessions. All papers were printed in advance so that the sessions could be devoted exclusively to discussion.

*We Sent Them Over—Bring Them Back*

## COMMITTEE ON INDUSTRIAL LIGHTING AT ATLANTIC CITY

**It Will Present a Brief Review of Industrial Lighting Practice, Together with Remarkable Results in Increased Factory Production**

An announcement from the Commercial Section of the National Electric Light Association says that the committee on industrial lighting is scheduled to present at the Atlantic City "Victory Convention" a brief review of the present average lighting practice in factories and other industrial establishments in comparison with the remarkable results in increased production obtained from some test installations giving true "productive intensities."

This material has been obtained by applying the ideas of the Lighting Sales Bureau's lecture at the 1916 convention, "Lighting By-Product or Buy-Product." As in the earlier talk, the points are illustrated with a model and demonstrations. The new apparatus shows both the defects of common practice and the principles and advantages of good lighting in such a simple manner that the facts are easily remembered and applied Productive intensities are developed as equally attractive to the central station and to its customers.

"W. A. Durgin's lecture and demonstration will be a treat. Don't miss it at Atlantic City," the announcement says.

## MORE EXHIBITORS FOR THE ATLANTIC CITY CONVENTION

**Additional Names of Exhibitors at the National Electric Light Association Supplement Earlier List—Committee Moves to the Pier**

An additional list of exhibitors at the National Electric Light Association convention, Atlantic City, during the week beginning May 19, has been issued by the exhibition committee. It has again been necessary to increase the space to take care of the many applications that have been received. The committee opened its office on the Million-Dollar Pier, Atlantic City, on May 1.

The list of additional exhibitors supplements the names published in the ELECTRICAL WORLD of April 19, page 800, and is as follows:

J. B. Beans, Philadelphia, Pa.
B C K Manufacturing Company, New Britain, Conn.
*Central Station*, New York.
Coffield Motor Washer Company, Dayton, Ohio.
Duplex Lighting Works of General Electric Company, New York.
Grether Fire Equipment Company, Dayton, Ohio.
Iske Company, Chicago.
Majestic Electric Development Company, Philadelphia.
Marlow Manufacturing Company, Cleveland, Ohio.
Shapiro & Aronson, New York.
Volk Manufacturing Company, Westport, Conn.
Wadsworth Electric Company, Covington, Ky.

# TOTALS LARGE IN REPORT OF GENERAL ELECTRIC COMPANY

## Orders Received in 1918 Aggregate $234,100,000, While Sales Billed in the Year Aggregate Total of $216,800,000—Service of the Men

While the totals of orders received by the General Electric Company in 1918 reached large figures, they were not so great as in the preceding year. On the other hand, the amount of sales billed was larger in 1918 than in 1917. The figures compare as follows:

| | 1918 | 1917 |
|---|---|---|
| Orders received | $234,134,037 | $246,778,491 |
| Sales billed | 216,815,277 | 196,926,318 |

In the twenty-seventh annual report to stockholders C. A. Coffin, chairman of the board of directors, refers twice, in his opening and in his concluding paragraphs, to the work done for the nation by those who are in the service of the company.

"The time and energies of many of your officers, engineers and experts," he says, "have been devoted to work of a distinctly national character, and every department and facility of the company have at all times been at the service of the government throughout the period of the war.

"The devotion of the employees in all branches of your company's service during the strain and high pressure of war-time demands is worthy of high praise, and the board of directors cannot conclude this report without making grateful acknowledgment of their splendid coöperation."

In speaking of the value of orders received in 1918, Mr. Coffin says that a considerable portion was represented by contracts with the United States Navy Department. Earnings compare as follows:

YEAR ENDED DECEMBER 31

| | 1918 | 1917 | 1916 |
|---|---|---|---|
| Net sales billed | $216,815,277 | $196,926,318 | $134,242,289 |
| Less: Cost of sales billed, including all operating, maintenance and depreciation charges | 188,439,521 | 167,921,778 | 118,948,198 |
| Total | $28,375,755 | $29,004,540 | $15,294,091 |
| Interest and discount | $2,112,280 | $1,433,317 | $1,539,499 |
| Income from securities | 2,325,782 | 2,661,150 | 1,844,645 |
| Sundry revenue | 168,254 | 417,822 | 482,738 |
| | $4,606,315 | $4,512,289 | $3,866,882 |
| Net income | $32,982,070 | $33,516,829 | $19,160,973 |
| Interest on debentures | $571,645 | $571,645 | $571,445 |
| Interest and discount on notes payable | 1,805,443 | 541,356 | ..... |
| | $2,377,088 | $1,113,001 | $571,445 |
| | $30,604,982 | $32,403,828 | $18,589,528 |
| Less: Federal income and excess profits taxes (estimated) | 13,500,000 | 5,500,000 | ..... |
| Profit available for dividends | $17,104,982 | $26,903,828 | $18,589,528 |
| Less: 8 per cent cash dividends | 9,165,622 | *11,165,882 | 8,121,646 |
| Surplus for the year | $7,939,360 | $15,737,946 | $10,467,882 |
| Previous surplus | 49,898,699 | 34,160,753 | 23,692,871 |
| | $57,838,059 | $49,898,699 | $34,160,753 |
| Less: 4 per cent dividends payable in stock | 4,587,398 | ..... | ..... |
| Total surplus | $53,250,661 | ..... | ..... |

* Includes 8 per cent cash, 1 per cent cash "Red Cross" and 2 per cent stock.

An important feature of the year was the provision of increased manufacturing facilities. Regarding these and the curtailment of production which followed the armistice Mr. Coffin says:

In order to expedite the completion of government and other contracts essential to the prosecution of the war, your company was forced to make heavy expenditures for additional manufacturing facilities. As a result the rate of production had reached the highest point in the company's history when the armistice was signed on Nov. 11, 1918. The cessation of hostilities resulted in suspensions and cancellations of orders, estimated at the date of closing the accounts at $30,000,000, leading a balance of approximately $80,000,000 of unfilled orders at the end of the year.

The expenditures for additional land, buildings, machinery and other equipment aggregated $21,593,996. As these facilities were required for the manufacture of apparatus and supplies urgently needed in the prosecution of the war, it was imperative that they be provided with the least possible delay and under circumstances which made economy of construction impossible.

In view of the fact that a portion of the recent additions to manufacturing facilities will for a considerable time be unused, and having regard to the high cost of such additions, the sum of $15,224,162 has been written off the plant account, and $3,186,793 will be included in the cost of unfinished contracts.

Of the total of $18,410,955, the sum of $1,918,702 was charged against the general plant reserve, leaving an increase of $5,101,744 in the book value of plant and equipment, as follows:

| | Gross Book Value | General Plant Reserve | Net Book Value |
|---|---|---|---|
| Real estate and buildings | $43,146,598 | $15,061,826 | $28,084,772 |
| Machinery | 31,810,044 | 15,854,665 | 15,955,379 |
| Patterns | 1,900,750 | 1,900,749 | 1 |
| Furniture and fixtures | 3,083,396 | 3,083,395 | 1 |
| Total | $79,940,789 | $35,900,635 | $44,040,154 |

On Jan. 31, 1918, the book value of the manufacturing plants was $3,958,528. During the twenty-five years ended Dec. 31, 1917, additional expenditures were made aggregating $110,955,804. There was expended during 1918 $21,593,997. The total of these items is $136,508,-329. The company wrote off or carried to "general plant reserve" during the twenty-six years $92,468,175. This left the book value of all plants, Dec. 31, 1918 at $44,-040,154.

The total factory floor space in 1918 was 19,581,000 sq.ft., as compared with 17,573,000 sq.ft. in 1917.

A number of other matters are then taken up by Mr. Coffin, as follows:

The increased prices of material and much higher labor costs have resulted in increasing the inventory accounts. After providing proper reserves and making adjustments in recognition of the decrease in market prices since November, 1918, the inventories in factories, district warehouses and consignment stocks are carried at $88,305,680, an increase of $6,454,369 as compared with 1917.

Customers' accounts and notes receivable have been carefully valued in accordance with the usual practice and, after allowing for necessary reserves, are carried at $41,548,688, an increase of $3,141,695 over the amount shown in December, 1917.

The book value of investment securities is $40,830,213, an increase of $3,481,605 as compared with Dec. 31, 1917. The principal increases represent the balance of your company's investment in Liberty bonds and in the capital stock of the Edison Electric Appliance Company, Inc.

Advances to subsidiary companies have been increased chiefly by advances to the Lawrence Park Realty Company of Erie, Pa., made at the request of the government for the purpose of erecting houses for the increased force of workmen engaged on contracts with the Navy Department. The government coöperated by a loan to your company of $1,000,000 of the required amount, to be liquidated within ten years.

The government has also advanced to your company $500,-000 as part of the cost of power and transportation facilities in the city of Erie, urgently needed for the production of machinery and apparatus for the navy. This sum your company in turn loaned to the public utility companies of Erie, receiving their obligations therefor. The total of your company's debt to the government is thus $1,500,000.

In order to provide additional facilities for the manufacture of incandescent lamps, your company has leased the Sandusky works of the Libbey Glass Company, with contract to purchase. Pursuant to the terms of the contract,

the General Electric Company has deposited with a trustee its 5 per cent debenture bonds of the par value of $2,265,000.

At the close of the year, after careful consideration, the board of directors decided that the interests of your company would best be served by segregating its investments and activities in foreign countries in manufacturing, selling, engineering and utility enterprises, etc., and transferring them to a separate company. For this purpose the International General Electric Company, Inc., was organized in January, 1919. It will at once take over the investments and conduct the activities above described in all foreign fields. Charles Neave, a valued member of your company's legal staff, has been elected chairman of the board of the new international company. Gerard Swope, formerly vice-president of the Western Electric Company, has been elected president, and M. A. Oudin, for many years manager of the foreign department of the General Electric Company, has been chosen as vice-president.

The outstanding capital stock of the company has been increased from $101,512,500 to $115,874,800 in the following manner: Subscriptions by shareholders in January, 1918, at par, on the basis of one additional share for each ten shares then outstanding, $10,061,218; amounts of the semi-annual stock dividends of Jan. 15 and July 15, 1918, $4,301,082; total increase, $14,362,300.

Of the employees, 8421 joined the military or naval forces of the United States during the war. Of these, 1880 have already returned and have been reinstated. All returning employees honorably discharged from military or naval service have been or will whenever possible be reëmployed, and when so reëmployed, Mr. Coffin states, will be held to have been continuously in the service of the company in regard to participation in pension and other benefits.

The balance sheet as of Dec. 31, 1918, shows that real estate, buildings, warehouses, etc., other than manufacturing plants are carried at $672,465. Furniture and appliances other than in factories stand at $1. Following the conservative policy of the company patents and franchises appear at $4,304,973 less a reserve of $4,304,972, or $1 net. Cash on hand was $24,010,024. Current assets stood at $156,288,707. Current liabilities were $27,416,082. The total surplus stood, as stated, at $53,250,661. There was also a general reserve of $6,100,000.

## *Peace Hath Its Victory Loan*

## STATE UTILITY COMMISSIONS FIGHT GOVERNMENT CONTROL

### About Forty Commissions Represented in Chicago Conference on Plans for Testing Federal Authority on Rates Before Supreme Court

Commissioners acting in behalf of public utility and railroad commissions of about forty states met in closed session at Chicago on Monday of this week to prepare briefs for submission to the United States Supreme Court on May 5, when the various suits to determine the respective authority of the United States government and the states in the matter of railroad and telegraph rates are to be heard. These briefs will maintain the position which the states have consistently taken, namely, that their own regulatory bodies, the railroad commissions and public utility commissions, have authority over intrastate rates. The events leading up to the suit are principally as follows:

In North Dakota the Railroad Commission was sustained in the state courts when it asserted its rights to regulate intrastate rates. This case has found its way to the United States Supreme Court. In Massachusetts the commission was not sustained when it asserted in the state courts its right to regulate intrastate telephone rates, the courts acting on the theory that the government cannot be sued. This case also has gone to the United States Supreme Court. A similar case in South Dakota has been heard. The state courts there sustained the commission. Once more the suit has been appealed to the Supreme Court of the United States. More recently in Illinois an injunction in the state courts was granted and later dissolved enjoining the Public Utilities Commission, the state courts and the Attorney-General from interfering with government action on intrastate telegraph rates.

The commissions of these states and of other states have been invited to be represented at the hearings before the United States Supreme Court and to file briefs "as friends of the court." Two separate briefs will be filed by the committee representing the various commissions, and separate briefs will be filed by some of the individual state regulatory bodies. The hearing before the United States Supreme Court has been advanced to May 5 at the instance of counsel for the Postmaster-General and the Railroad Administration.

## *They Went, They Saw, They Conquered*

## ADMINISTRATION TO RETURN WIRE LINES TO THE OWNERS

### Official Announcement that Government Will Surrender Control of Cables—Indication of Action on Telephone and Telegraph

In official statements issued in Washington on Monday of this week the Postmaster-General announced the early return of the ocean cable systems to their owners and that he would recommend the return of the telegraph and telephone properties as soon as legislation can be passed. The statements follow:

The Postmaster-General has recommended to the President that the government return the cable lines to their respective owners. This action is made possible by the fact that the congestion resulting from war conditions has largely passed. The enemy commercial blacklist has been abolished and the tremendous volume of government cable messages from and to the War Trade Board has ceased. The bar to commercial code messages has been removed, thus materially lessening the cable loads. The use of the cables in connection with the peace conference has been greatly diminished. The Postmaster-General hopes that the return of the cables may be effective not later than May 10.

The Postmaster-General will also recommend that the telegraph and telephone lines be restored to their respective owners as soon as legislation can be secured from Congress safeguarding the interests of the owners in every way that it is possible to safeguard them. The information of the Postmaster-General as to the condition of the wire companies convinces him that it is imperative that such legislative action must be had before the various telegraph and telephone lines are returned. This is not true as to the cable lines, which are in a condition to be returned at once.

A later order fixed the date for the return of the cable systems as midnight May 2.

## *Your Money Will Bring Some Back*

## HELP ALONG "NATIONAL PROSPERITY CAMPAIGN"

### "The Public Should Have a Clear Conception of the Changed Economic Conditions of the World," Says P. H. Gadsden

An exensive organization is pushing the "National Prosperity Campaign." Its slogan is "Let's go," and its headquarters are in the Hotel Commodore, New York. P. H. Gadsden, vice-president United Gas Improvement Company, Philadelphia, and chairman of the National Public Utilities Committee, is chairman of the organization committee. The other members are as follows:

Milton E. Ailes, vice-president Riggs National Bank, Washington, D. C.
E. P. Albrecht, president Philadelphia Bourse, Philadelphia.
John J. Arnold, vice-president First National Bank, Chicago.
Alexander C. Brown, president Brown Hoisting Machinery Company, Cleveland, Ohio.
Joseph E. Davies, former chairman Federal Trade Commission, Washington, D. C.
Cardinal Gibbons, Baltimore, Md.
H. W. Gossard, president H. W. Gossard Company, Chicago.
John Hays Hammond, Washington, D. C.
Charles F. Lang, president Lakewood Engineering Company, Cleveland, Ohio.
James H. McGraw, president McGraw-Hill Company, Inc., New York City.
Franklin T. Miller, president F. W. Dodge Company, New York City.
Julius Rosenwald, president Sears, Roebuck & Company, Chicago.
Frank A. Sieberling, president Goodyear Rubber Company, Akron, Ohio.
E. T. Trigg, general manager John Lucas Company, Philadelphia.
S. M. Williams, president Highway Industries Association, Washington, D. C.

In a letter to American business men Mr. Gadsden discusses the needs of business conditions to-day. He declares that American prosperity now depends upon the spirit of service of business men.

"The country needs education even more than it was needed during the war," says Mr. Gadsden. "The changes of conditions, commercially, economically and socially, since the European war began have been so vast and so rapid that the average man has only a faint appreciation of how far-reaching and how fundamental they are. People think that because the war is over we can go back to pre-war conditions, levels of prices and wages.

"This, of course, is impossible, but until its impossibility and the reasons why it is impossible are understood by the general public the public mind will be in a state of hesitation and confusion, particularly with regard to buying and selling.

"With a sense of this situation and a belief that the country is waiting for leadership, several of the leaders of thought in the country have given their approval to the inauguration of a campaign to stimulate a clear understanding of conditions as they are, to bring about a realization of the fact that we are in a new world, and to start the thinking of the public along lines which are in accord with to-day's conditions.

"Advertisements have been prepared to visualize and exploit some of the simple fundamental and most important points in the situation in an effort to give direction to public thought and action. It is believed that if this and similar educational material is brought to the attention of the country in a sufficiently emphatic and continuous way to get it definitely across, it will lead to a go-ahead spirit in business which will be reflected in the immediate and continuous improvement of business conditions in general.

"It is in the interest of American business that the public should have a clear conception of the changed economic conditions of the world and of the basic reasons why this country should now go ahead energetically and enthusiastically in a spirit of unity and harmony.

"In your own interest and in the interest of American business will you see to it that this campaign is given full publicity so that it will effectively reach your customers and your buying public?"

An executive staff, of which Mr. Gadsden is chairman, is ready to furnish copies of the advertisements and other material designed to promote prosperity upon application to the "National Prosperity Campaign," Suite 700, Hotel Commodore, New York City.

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## BATTLESHIP TENNESSEE LAUNCHED IN BROOKLYN

### Electrically Propelled Superdreadnought, Is Now 60 per Cent Completed and Will Be Ready for Service Early in 1920

The battleship Tennessee, which is to be electrically propelled, was launched at the Brooklyn Navy Yard on Wednesday of this week. This superdreadnought, representing the largest unit in the navy of any nation, is now more than 60 per cent finished. The expectation is that it will be fully equipped early next year.

A sister ship of the Tennessee, the California, is under construction at the navy yard at Mare Island, Cal. It is to be launched in the fall.

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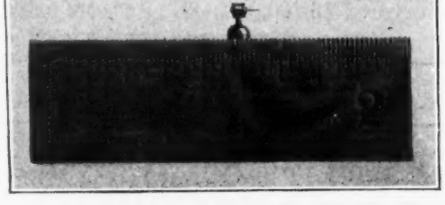
## The Smallest Turbine in the World



What is believed to be the smallest operating turbine ever built has been completed by Ivan T. Nedland, Hillsboro, N. D. Mr. Nedland also built the smallest electric motor and the smallest steam engine in the world, these being on exhibition at the Panama Pacific Exposition in San Francisco and also at the University of North Dakota. The turbine is smaller than either of the other small devices. The rotor is made of steel and has six slots. The diameter of the rotor is 0.032 in. and the shaft is 0.007 in. in diameter. The weight of the rotor is 2 mg. The diameter of the complete turbine is 0.048 in., or about one-half the diameter of an ordinary pin head. The complete turbine weighs 12 mg. The turbine will not run with steam as that fluid is too heavy for it to operate on. It is mounted on a hollow pedestal so that an air hose can be attached to the bottom. It will run at vary high speed when air is applied. The casing of the turbine is made of gold. The complete machine consists of eight parts. It is kept in a glass case so that moisture, which would affect its running, will be excluded.

## PROGRAM FOR CONVENTION OF CONTRACTORS AND DEALERS

### Nineteenth Annual Gathering to Be Held at Milwaukee from July 14 to 18 Will Consider Many Subjects of Interest

Following is the tentative program for the nineteenth annual convention of the National Association of Electrical Contractors and Dealers to be held in Milwaukee from July 14 to 18:

*Monday, July* 14, 1919.—Executive committee meetings at the Hotel Pfister at 10 a. m. and 2 p. m.; registration bureau to open at the Hotel Pfister at 4 p. m. on this day.

*Tuesday, July* 15, 1919.—Executive committee meetings at the Hotel Pfister at 10 a. m. and 2 p. m.

*Wednesday, July* 16, 1919.—Opening session of convention at auditorium at 10 a. m.: opening address, representative of the Wisconsin State Association; address of welcome, representative of the state government; response by national chairman, W. Creighton Peet; address on coöperation, speaker to be selected. Convention session at auditorium at 2 p. m.: address on standard cost-accounting system, illustrated by lantern slides; report on estimating forms and methods. Reception and dance at Hotel Pfister at 9 p. m.

*Thursday, July* 17, 1919.—Outing at Waukeshaw Beach; special trolley cars to beach leaving at 8:30 a. m. Convention session in pavilion at 10:30 a. m.: address on general business conditions and outlook, speaker to be selected; address by W. L. Goodwin; lunch to be served in the pavilion; afternoon to be devoted to sports.

*Friday, July* 18, 1919.—Convention session at auditorium at 10 a. m. Section meetings: "Repair and Sale of Used Apparatus," A. L. Swanson, chairman; addresses on methods of determining value of burned-out apparatus, what constitutes efficiency in the repair business, methods of dealing with the public; discussion. "Merchandising and Fixture Dealing," J. A. Fowler, chairman; addresses on arrangement and conduct of a retail store, relation of the dealer to the public in merchandising; discussion. Meeting of state and local secretaries, J. P. Ryan, chairman. Convention session at auditorium at 2 p. m.: address on labor, speaker to be selected. Matters referred to the convention by the executive committee. Annual dinner (informal) at Hotel Pfister at 6:30 p. m.; no speaking; singing led by James R. Strong.

*Saturday, July* 19, 1919.—Meeting of executive committee at Hotel Pfister at 10 a. m.

Additional entertainment features, including the entertainment provided for the ladies, will be announced in later program. All meetings of the convention and the executive committee are open to all persons interested and full discussion of all subjects presented is invited. The association headquarters will be the Hotel Pfister.

## RATE ORDER MODIFIED BY NEW YORK COMMISSION

### First District Commission Rescinds Order for 8-Cent Rate in Flatbush and Authorizes a Maximum of 10 Cents

On motion of Commissioner Charles S. Hervey, the New York Public Service Commission for the First District has issued an order fixing the maximum rate to be charged by the Flatbush Gas Company for electricity at 10 cents per kilowatt-hour, effective on and after May 1, 1919.

The order of the commission follows a rehearing after a decision made by it on Feb. 1, 1918, at which time the rate charged by the company was 12 cents per kilowatt-hour. The order of Feb. 1 fixed rates effective at various times, the final rate to be 8 cents per kilowatt-hour on and after March 1, 1919. An appeal from this order was taken to the courts by the company on several grounds, particularly in reference to the forecast of the commission as to the company's earnings during 1918 and 1919, which the company held was too low an estimate. The appeal is still pending. The company also applied to the commission for a rehearing, which was granted with the above result.

Commissioner Hervey found that the estimates of the commission as to the probabilities of revenue and expenses during 1918 and 1919 were too low.

## New Generating Facilities at the Denver Central Station

Additions have been made to the Lacombe generating station of the Denver Gas & Electric Company, a Doherty property. As the existing engine room had ample capacity for the turbine and condenser equipment, the new buildings are a boiler room and a transformer house. That additional facilities were necessary is shown by the fact that the output of electrical energy for the three months ended March 31, 1919, increased over 30 per cent above 1918.

## NEW YORK COMPANIES PLAN CONSOLIDATION

### United Hudson Electric Corporation to Acquire Kingston and Water-Power Properties and Transmission Lines in District

Application has been made to the New York Public Service Commission, Second District, by the United Hudson Electric Corporation for authority to acquire the capital stock of the Kingston Gas & Electric Company, including the Ulster Electric Light, Heat & Power Company, and 775 shares of stock of the Upper Hudson Electric & Railroad Company of Catskill. Authority is also asked to purchase the stock of the Rifton Land Corporation and to develop two water-power sites on the Wallkill River at Dashville. One of these will have a capacity estimated at 50,000 hp. in the near future. Another proposed activity of the company, for which it asks authority from the commission, is the purchase of transmission lines built recently near Kingston, Newburgh and Poughkeepsie. The company was incorporated on Feb. 14 to operate in Ulster, Greene, Albany, Dutchess, Putnam and Orange Counties. Its capital is $3,000,000.

*You Got the Victory—Buy Notes*

## AIM OF PUBLICITY CAMPAIGN OF THE JOBBERS' ASSOCIATION

### Statement of Its Purpose in Connection with Relations of Jobber to Other Elements in the Industry

The following has been issued in regard to the publicity campaign of the Electrical Supply Jobbers' Association:

At the meeting of the Electrical Supply Jobbers' Association held at Hot Springs, Va., May 22-23, 1918, a publicity committee was appointed to make an investigation of the means to be employed and the expense involved in conducting a campaign of publicity the purpose of which would be to set before the trade certain facts concerning the nature of the business and the purpose and work of the association.

The publicity committee, composed of A. M. Little, president of the Mohawk Electrical Supply Company, Syracuse, N. Y., chairman; F. R. Elliott, president of the Elliott-Lewis Electrical Company, Inc., Philadelphia, and F. D. Van Winkle, president of the Post-Glover Electric Company, Cincinnati, Ohio, presented its report at the Cleveland meeting of the association, Dec. 9 to 11, 1918, and an appropriation of $12,000 was voted for the committee to continue its work.

Subsequently arrangements were made to lay out a plan which includes the use of advertisements in electrical journals, reprints of these advertisements for mailing by the members of the association, booklets describing the campaign for the use of members and members' salesmen, booklets for distribution to the trade, a prize contest for the best essay on jobber distribution from the central-station and contractor-dealer standpoint with suitable and generous compensation for the winner, conference and correspondence with the editors of the electrical journals, and an exchange of experiences, ideas and suggestions with other associations in the industry and with other associations of jobbers.

In connection with the use of the electrical journals it was decided to spend approximately $8,000 for advertising space out of the total of $12,000 available. The schedule includes a total of 108 pages of advertising in the papers selected, not less than nine pages in any one month, as many as thirteen pages in one month, and including six double-page spreads.

The publicity campaign began in the March issues of the publications selected and will be continued throughout the remainder of the present year.

There has been some misapprehension regarding the purpose of the publicity campaign, especially with regard to the motives back of it, in connection with the relations of the jobber in general to other elements in the industry.

The publicity campaign is directed primarily to increase the use and consequently the sale of electrical apparatus and supplies. Anything that retards the rapid introduction and wide distribution of electrical goods holds back the industry. The business of the jobber has been evolved out of the necessities of both producer and buyer. On the part of the producer there is and has always been since the electrical industry assumed national proportions a need for means to speedily reach all points of possible demand and the assurance of business in such quantity as would stabilize production. On the part of the buyer there is and has always been a need for access to stocks near at hand in such combinations that, no matter how numerous or how few his requirements might be from day to day, his wants might always be supplied at short notice and at low cost.

In the great growth of the industry the function of the jobber has never been displaced, and the trade channels which have been established through the necessities of the producer and buyer have never been diverted. While, on the one hand, the functioning of the jobber has contributed thus to the rapid development of the industry, this very development has, on the other hand, brought about many problems of distribution which have made this jobber function more and more a necessary factor, and constant study of all of of the elements entering into such distribution have been made to keep even the balance between economy and expediency.

The purpose of the Electrical Supply Jobbers' Association is to study through associated efforts the factors underlying the most intelligent methods of doing business and to make available for the individual the lessons taught by the aggregate experience of all of its members. The statistics which the various committees of the association are gathering are analyzed and business methods so adjusted as to keep pace with the development of the electrical industry and the consequent increasing demand for jobber representation.

This being the purpose of the association, the purpose of the publicity campaign is to reveal to the trade definite information along these lines, so that every element interested, from producer to ultimate consumer, may understand clearly the advantages that all derive from adherence to a policy of jobber distribution.

In carrying out the publicity campaign no effort is intended to usurp the function of other elements in the industry, nor to divert to the jobber any recognition other than that which a fair and honest evaluation of his services inspires. In the benefits that may accrue all elements in the industry—non-members as well as members of the association—will participate.

## Exhibits at Bureau of Standards

An extensive exhibit of war materials was made at the Bureau of Standards, Washington, on April 25 to 29 in connection with the ninety-seventh regular meeting of the American Physical Society.

Private manufacturers, educational and other research laboratories and government departments furnished exhibits. One of the exhibit rooms is illustrated herewith.

## NEXT MEETING OF THE ELECTRIC POWER CLUB

### Gathering to Be Held at Hot Springs, Va., on May 22, 23 and 24—Copies of the Standardization Rules in Hands of Secretary Roth

The Electric Power Club will hold its next meeting at the Homestead Hotel, Hot Springs, Va., on May 22, 23 and 24.

C. H. Roth, secretary of the club, 1410 West Adams Street, Chicago, has copies of the standardization rules of the club, which will be sent to persons interested.

*Please Lend on These Notes—U. S.*

## ENGINEERING SOCIETIES FOR DEPARTMENT OF PUBLIC WORKS

### Seventy-four Societies Represented at Conference in Chicago—Principles Adopted with Reference to Character of Proposed Department

Representatives of seventy-four engineering societies, having a combined membership of over 100,000, met in Chicago last week and, as a result of discussions occupying two full days, formed an organization to promote the passage by Congress of a bill creating a federal department of public works. Principles were adopted for determining the character of the proposed department and specific recommendations made as to the services and bureaus to be incorporated therein. The drafting of the bill itself was left to a committee with full power and the management of the organization to an executive committee, which was authorized to appoint a finance committee, to which in turn will be left the problem of raising the necessary funds. A campaign committee was also authorized and in part appointed. Sessions were also devoted to a consideration of government coördination in mapping the United States and to the relations of non-member organizations to the Engineering Council A dinner was given the delegates by the general committee of the technical societies of Chicago (F. K. Copeland, chairman), while the Western Society of Engineers placed its meeting hall, stenographic and other facilities at the disposal of the conference.

J. Parke Channing, chairman of the Engineering Council, set forth the purpose of the conference and the general reasons why engineers had repeatedly urged the formation of a federal department of public works. He made it clear that the Engineering Council desired, in connection with the conference, to afford only the means of bringing the delegates together, and that it had no desire to be a determining factor in the conclusions reached. For that reason the Engineering Council and its members who happened to be present would have no voice in the proceedings.

M. O. Leighton, chairman National Service Committee, was elected chairman of the conference, and E. S. Nethercut, secretary Western Society of Engineers, secretary of the conference.

**Philip N. Moore, St. Louis, presented the report of** the National Service Committee. This stated that the public good demanded the coördination of the engineering activities of the government and that this demand was so fundamental that sooner or later it was sure to be complied with. It would be better, he contended, that engineers should be instrumental in bringing about the necessary coördination than that it should be left to others.

There was general appreciation of the necessity of organizing the profession down to the last congressional district in order that the merits of the proposed measure might be brought home to members of Congress through the public and through engineers resident in each congressional district. The lack of national organization of the profession was brought up repeatedly and much deplored, the discussion at times broadening out to include suggestions for the coördination of all elements of the profession. J. Parke Channing, chairman of the Engineering Council, pointed out that the council was still in its formative stage and so far had included only national engineering societies. An amendment was pending, however, which, if adopted, would permit of the affiliation of local societies as well. He was of the opinion that engineers might learn from the American Federation of Labor, which is very loose in its organization and admits all bodies that can contribute to its ends. He offered the services of the National Service Committee to the conference in its work of promoting the public works department bill.

**W. H. Hoyt of Duluth maintained that there was** need for a paper devoted to the public and civic interests of engineers. Mr. Channing agreed on the need for such a paper, pointing out that it had been considered by the Engineering Council but that the council could do nothing in the matter for lack of funds. E. J. Mehren, on behalf of the McGraw-Hill Company, offered to the conference space in the journals owned by that company in the promotion of the bill. A similar offer was made by other papers.

A resolution was passed providing that the conference be known as the Engineers, Architects and Constructors' Conference on National Public Works.

*Victory Notes We Sing, Also Buy*

# MORE THAN PROFIT TAKING IN INTERNATIONAL TRADE

## Maurice Coster Tells National Foreign Trade Council that This Is the Time to Assist in Restoring Normal Conditions in Allied Countries

Maurice Coster, managing director Westinghouse Electric Export Company, made an address on "Our Export Trade with Europe" before the National Foreign Trade Council, which met in Chicago on April 24 to 26. Mr. Coster returned recently from a personal investigation of European conditions. He directed attention to the great importance to the manufacturing exporters of this country of a proper understanding of conditions on the other side before they make plans for development of their European sales.

Mr. Coster said that Great Britain, for instance, in addition to the enormous debt which she incurred during the war, has sold almost all her foreign holdings with the exception of £2,000,000,000 of South American securities, which she has retained to prevent the severance of her trade relations in that quarter.

The debt of France is so great that it has been estimated that every man, woman and child in France now owes the rest of the world a thousand dollars.

Italy is laboring under an enormous burden of debt and, without adequate natural resources of her own, such as coal and iron, is in even a worse position than Great Britain or France.

However, even more important from an industrial viewpoint than the financial difficulties of these countries, declared Mr. Coster, is the staggering loss to their productive man power which they have endured.

It is true that in certain industries women were called in during the war to take the place of the men at the front. There is general agreement that the labor of these women has been satisfactory and that they will continue to occupy an ever-increasing place in the industrial life of Europe. On the other hand, it must be remembered that it will take some years for the infiltration of women into general industry to be accomplished and even longer for them to take the place of the skilled workers who will never return.

The speaker said that at the present moment our allies are engaged in a desperate endeavor to effect the transition from a war to a peace basis. Their problem in this regard is infinitely greater than our own, because, unlike ourselves, they depended upon other nations during the war for peace-time necessities and transferred practically their entire industrial strength to manufacturing the munitions of war. It will take at least two years to place the factories of England, France and Italy in the same position for peace-time production which obtained before the war.

This, then, is the picture which every American manufacturer should have before his eyes when he considers developing his trade in the allied countries. Practically untouched by the war, he is in a position to undersell the industries of the Allies in their own markets. If he were permitted to go freely into these markets and compete without restriction, it would mean the temporary, if not the permanent, destruction of Europe's industries. Continuing, Mr. Coster said:

> I do not believe that any intelligent American business man would desire to see such a situation created. We have built up our domestic trade on the theory that the manufacturer's best interests are served when his customers are prosperous. We cannot build up our international trade by ignoring the best interests of our foreign customers.
>
> I am very firmly of the opinion that nothing could be worse for the future of America's foreign trade than the permission to enter into unrestricted competition with the manufacturers of England, France and Italy in their home markets.
>
> England, France and Italy are now working out plans for their domestic salvation. In these plans they should have our assistance rather than our interference. They know better than we do what is necessary for the restoration of their industries. Our first and most important duty is to give them full assurance that we understand their problems, sympathize with their difficulties and stand ready to supply them with what they need rather than what we want to give them.
>
> This does not mean that we shall not have an export trade with the Allies—quite the contrary. Those things which they cannot make themselves must be secured from us. Just as food and certain raw materials are now flowing in a steady stream from this country to the other side, so in an ever-increasing volume will go those manufactured articles which these countries need for the restoration of their industries and for the development of their business.
>
> Furthermore, while the European countries are restoring their domestic affairs, the demand of the rest of the world for our products will be greater than ever before. What we lose in Europe by taking the large-minded view will in a measure be compensated for by the increased opportunities presented by those countries which formerly drew the greater part of their imports from Europe.
>
> Europe, I am firmly convinced, will not be in a position for many years to meet the requirements of South and Central America and the Orient. These are the fields to which the American manufacturer should direct his energies with almost certain promise of profitable and increasing trade.

Mr. Coster then turned to a consideration of the conditions that will prevail when Europe at last becomes normal and expressed the belief that there will be greater opportunity for the American exporter than ever before.

In the first place, he will no longer be confronted with the obstacle of cheap European labor. The leaders of thought on the other side are convinced that the present effort to raise the standards of European wages more nearly to the level with American standards will be successful, and there are evidences on every hand that the organized labor of Europe is determined to secure the recognition which can only come through higher wages.

In the second place, Mr. Coster continued, the standard of living in the allied countries has been raised.

These two factors, higher standards of wages and of living, mean that in years to come the manufacturers of this country will find better markets abroad for American products than they ever had before the war.

"We may go out of European competition for a while, but in the long run the changes brought about by the war will, I think, be favorable rather than unfavorable to this country's European trade," said Mr. Coster in conclusion. "The important thing at the present moment is that we shall do nothing which shall cause our friends across the ocean to lose confidence in our friendship or our good faith. We must make it clear that, while we are business men, we believe that there is something more than profit taking in international trade. Alone of the great producing nations, we are in a position to play a tremendous part in the salvaging of Europe's commercial structure, and the more generously and intelligently we perform our part, the greater the prospect there will be for a permanent and gratifying expansion of our future European business."

## *Associations and Societies*

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 927 of this number.

**Cleveland (Ohio) Electrical League.**—Harold T. Clark told some of his experiences at the peace conference to the league members on April 24.

**Arkansas Utilities Association.**—May 20, 21 and 22 are the dates set for the annual convention of the Arkansas Utilities Association, which is to be held in Fort Smith, Ark.

**A. I. and S. E. E., New Section Formed.**—The Birmingham Section of the Association of Iron and Steel Electrical Engineers has been organized and will hold its first regular meeting to-day to elect officers.

**Annual Meeting of the S. E. D.**—The Society for Electrical Development, Inc., will hold its annual meeting at 10.30 o'clock on the morning of May 13 at the society's offices in the Engineering Societies Building, New York City.

**Institute of Radio Engineers.**—A meeting of the Institute of Radio Engineers is to be held on May 7 in the Engineering Societies Building, New York City. "The Detecting Efficiency of the Thermionic Detector" is the title of a paper which will be presented by Dr. H. J. van der Bijl of the Western Electric Company. This paper describes convenient methods for measuring absolutely or by comparison the true detecting efficiency of vacuum tubes.

**I. E. S., May Meeting.**—"Marine Camouflage" will be the subject discussed at the May 8 meeting of the Illuminating Engineering Society, which is to be held in the Engineering Societies Building, New York City. These papers will be presented: "The Growth of Marine Camouflage," by Lieut. Harold Van Buskirk, U. S. N.; "The Science of Marine Camouflage Design," by Lieut. Everett S. Warner, U. S. N., and "The Low-Visibility Phase of Marine Camouflage," by Dr. Lloyd A. Jones, Eastman Kodak Company.

**Ohio Electric Light Association.**—Committee meetings of the Ohio Electric Light Association were held at Dayton on April 17 and 18. The transmission and distribution committee heard the following papers: "High-Tension Transmission-Line Operation," by Frank Howard, general superintendent Wheeling (W. Va.) Electric Company, and "Type and Rupturing Capacity of Oil Switches for Substation and Transmission Lines," by J. B. MacNeill, East Pittsburgh, Pa. The program of the meter conference included papers by A. H. Bryant, Cleveland (Ohio) Electric Illuminating Company, on "Scheduling Service Tests of Small-Capacity Meters," and by J. L. Wright, Toledo Railways & Light Company, on "Training Men for Meter Work."

**Baltimore Get-Together Meeting.**—A meeting of contractor-dealers in conjunction with the jobbers, manufacturers and central-station men was held in Baltimore, Md., April 15.

**Massachusetts State Association of Electrical Contractors and Dealers.**—The monthly meeting for the Boston district of the Massachusetts State Association of Electrical Contractors and Dealers was held March 20.

**Electrical Men to Meet in Portland, Ore.**—A meeting of jobbers, contractors, dealers, central-station men and manufacturers to stimulate business in the electrical industry will be held at Portland, Ore., on May 21 and 22.

**Engineers' Club of Trenton, N. J.**—J. F. Lincoln, vice-president of the Lincoln Electric Company, Cleveland, Ohio, gave an illustrated talk on "Electric Arc Welding as Applied to Present-Day Commercial Manufacturing and Repairs" before a recent meeting of the Engineers' Club of Trenton, N. J.

**Engineers' Society of Milwaukee.**—The monthly meeting of the society was held under the auspices of the Milwaukee Section of the American Institute of Electrical Engineers on April 29. A. A. Oswald of the Western Electric Company gave an illustrated talk on "Wireless Telephony and Telegraphy in War."

**New York Electrical Society.**—The 373d meeting of the society was held on April 24. Charles E. Clarke of the United States Employment Service gave an address on "How the Government Is Meeting the Unemployment Situation," and Dr. Gilman Thompson lectured on "The Functional Reëducation of the Soldier and the Civilian."

**Southwestern Electrical and Gas Association.**—At the "Victory" convention of the Southwestern Electrical and Gas Association, to be held in Galveston, Tex., on May 12, 13 and 14, there will be two special sessions each for the gas, the electric light and power, and the street and interurban railway sections. There will be a "round-the-table" discussion at every session. Two general sessions will also be held.

### American Institute of Electrical Engineers

**Denver Section.**—Paul M. Lincoln, past-president of the American Institute of Electrical Engineers, addressed the meeting held on April 19, his subject being "The History of Power Transmission."

**Philadelphia Section.**—The April 14 meeting of the section was devoted to a discussion of the work of the committee on development. F. L. Hutchinson, J. F. Stevens and Dr. William McClellan were the principal speakers.

**Detroit-Ann Arbor Section.**—On April 11 Prof. John C. Parker, University of Michigan, led a "round-table talk" on "Direct-Current Motors," discussing the speed and torque characteristics in reference to the adaptation of the various types to specific load applications. Prof. B. F. Bailey, University of Michigan and consulting engineer for the Howell Motor Company, gave a "round-table talk" on "Induction-Motor Characteristics" at the April 25 meeting.

## *Commission Rulings*

Important decisions of various state bodies involving or affecting electric light and power utilities.

**Discount on Bonds Sold.**—In authorizing the Commonwealth Edison Company of Chicago to issue $4,000,000 bonds to discharge short-time loans and reimburse the treasury for capital expenditures the Illinois Public Utilities Commission provided that the bonds should be sold to net 90 and interest and that the sales expenses should be amortized from income or charged to profit and loss.

**Increase in Rates in California.**—The Western States Gas & Electric Company has been authorized to increase its rates for gas and electricity in the Stockton district, the Railroad Commission having found that the rates fixed for gas last June and the electric rates fixed last November fail to yield a reasonable return to the company. This is due to added cost of oil and material, labor and taxes. The new rates for electricity are still ordered in the shape of a surcharge, the principal change being made in the flat rate for commercial lighting, which is increased from a 5 per cent to a 10 per cent addition to the monthly bill. The surcharge for energy sold for power service is increased from 1 mill a kilowatt-hour to 1½ mills a kilowatt-hour, and the surcharge for railway power and for energy sold other utilities is made 1 mill a kilowatt-hour, an increase of 0.5 mill. There is no change in the surcharge of 5 mills a kilowatt-hour for energy sold for domestic, commercial and municipal metered lighting other than street lighting. The new rates went into effect March 20. The company's estimates were accepted as reasonable by the commission, excepting the claim for taxes. This the commissioners cut from $30,641 to $23,846, holding to the view expressed in a previous Western States rate case, that federal war taxes should not be passed on to the consumer but should be borne by the utilities.

## *Current News and Notes*

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

**Metric System Urged.**—The World Trade Club, San Francisco, has issued a booklet urging that messages be sent to American and British authorities asking the adoption of the metric system of weights and measures in the United States and in Great Britain and her dependencies.

**Members for Society of Electrical Development.**—J. M. Wakeman, general manager Society for Electrical Development, has written to members inclosing booklets to interest men in the industry "who should be supporting the society but who are not doing so. There are thousands of concerns all over the country reaping the benefit of the society's work and contributing nothing to the expense entailed. The larger the membership the more effective will be the work of the society. The cost of membership is small, and the work is absolutely necessary to the industry."

**Popular Demand for Street Lighting Again.**—In some matters newspaper editorial comment can be said to reflect generally the sentiments of the locality from which the paper comes. Because this is usually true the following editorial from a Grand Rapids (Mich.) paper is interesting as indicating the trend of the popular mind on the subject of street lighting: "We cheerfully submitted to privations and to dim lighting during the war, but that conflict's over now and we ought to give signs that we're prosperous and assume a 'front' even if we haven't one. But we know that we are advancing fast in every way. Don't let us hide our light under a bushel any longer."

**Far-Reaching Rate Increase in Illinois.**—In an application for authority to increase rates for electric service in 148 communities served by the Central Illinois Public Service Company, Mattoon, an agreement was reached between the company and the communities in which rates were advanced 0.5 cent per kilowatt-hour. In opposing the increase attorneys representing the 148 communities filed objections to the service rendered, and the commission's order in the case directs the company to make a general survey of its property as to its transmission system, the source from which it receives its power, the capacity of its lines, the character of the switching and lightning protection apparatus employed, the adequacy of the installation of the system and the nature of interruptions to the system and the causes therefor, and to report the findings to the commission within one year from the receipt of this order.

**Knox County Electric Company.**—Effective April 1, 1919, the name of the Rockland, Thomaston & Camden Street Railway, Rockland, Me., was changed to "Knox County Electric Company." All directors and officers of the corporation will remain the same, the name only undergoing any change. Its affairs will be managed and carried along as previously, but under the new name.

**Electrical Smelting for the Dutch East Indies.**—Considerable study has been made by the Dutch engineers as to the working of the iron fields in the Middle Celebes, in what is known as the lake district of Netherlands India. It appears that two methods are open, the smelting of the ore by the carbonization of coals, the coals of Ombilin and Lematan being quite well adapted for carbonization, or by electrical smelting. The latter method is preferred, as it is believed there is sufficient water power in the neighborhood of the ore beds and electrical machinery for the purpose can be established at a low cost. An examination of the water-power possibilities is now being made. The reduction expedient, wood coal, which is necessary for electrical smelting, can be obtained in abundance near the ore fields.

**Consolidation of Massachusetts Commission Reported in Bill.**—A bill providing for the consolidation of the Public Service Commission and the Gas and Electric Light Commission of Massachusetts was reported last week by the special committee on commissions of the Massachusetts Legislature. The bill creates a Department of Public Utilities under the direction and charge of a Commission on Public Utilities, to consist of five persons appointed for five-year terms, except that the initial appointments range from one to five years. The Governor is to designate the chairman of the commission, and the departments will embrace all public utilities. The chairman, with the approval of the Governor and Council, is annually to designate two members of the commission to act with himself as a board to administer the laws relating to railroad, railway, telephone and telegraph companies—this to include all matters now coming within the jurisdiction of the Public Service Commission—and two members to act with himself as a board to administer the laws relating to gas, electric and water companies; *i.e.*, all matters now within the jurisdiction of the Gas and Electric Light Commission. Each of these boards is to elect its own chairman and respectively exercise all the powers now vested in the commissions at present existing. All employees of the existing commissions, as temporary employees, would continue under the bill to perform their usual duties until removed, appointed to positions under the act or transferred to other departments.

## *Recent Court Decisions*

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

**Contract for Power to Operate City Street Railway.**—A contract for electric power to operate the street-railway system acquired by city of Seattle, payment to be made from revenues derived from the system, has been held by the Supreme Court of Washington to be within power of the City Council (179 P. 127).

**Injury to a Servant.**—In a case where the floor of a building was several feet above an opening from an alley into a dark elevator shaft, a servant fifteen years of age, who saw another servant on a ledge at the bottom of an opening into the alley attempting to open a door for purposes of ventilation and, without invitation and without looking, ran and jumped into shaft to aid him, thinking elevator was on level with ledge, was guilty of contributory negligence, according to a decision handed down by the Supreme Court of Missouri (209 S. W. 931).

**Power to Make Contracts.**—Where articles of a corporation formed by the consolidation of pre-existing corporations chartered under special acts in no way restricted the powers which the old corporations possessed, and further declared that the new corporation might guarantee any dividends and make contracts for the furthering of its business, it was held by the Supreme Court of Alabama (815 S. 4) that the corporation which was engaged in the street-railroad business, as well as furnishing of electricity, etc., might contract to pay a manufacturing company a sum of money on its removal of its plant from one point and reconstruction of the same on the corporation's right-of-way, etc.

**Basis for Review of Commission's Orders.**—The Supreme Court of Illinois has held that under the public utilities act, Section 68, it is not sufficient to justify a reversal of a reasonable order of the Public Utilities Commission, made in lawful exercise of its powers, that the court of review should be of the opinion that the order was unwise or inexpedient, but to justify a reversal on ground that the order was unreasonable it must be arbitrary action not resting on a reasonable basis for exercise of discretionary powers. The court reviewing an order of the Public Utilities Commission will examine facts upon which it is based, and, if there is substantial evidence to sustain the order, not a mere scintilla of proof the order will be sustained (122 N.E. 478).

# *Men of the Industry*

Changes in Personnel and Position—Biographical Notes

**M. F. Bonham,** formerly assistant manager of the Southwestern Gas & Electric Company at Texarkana, Tex., has been made manager of the Arkansas Light & Power Company. Newport, Ark.

**R. E. Thompson** has been appointed manager of the Deming Ice & Electric Company, Deming, N. M., to succeed M. E. De France, who has gone to Trinidad, Col., as superintendent of power for the Trinidad Electric Transmission Railway & Gas Company.

**Dr. William McClellan,** a well-known engineer who was appointed dean of the Wharton School of Finance and Commerce of the University of Pennsylvania in 1916, has resigned to resume his former relations in the firm of McClellan & Champion, with engineering offices in New York and Philadephia.

**E. A. Bechstein,** for the last two years second vice-president of the Sandusky (Ohio) Gas & Electric Company and for a number of years before that general manager, has resigned to become associated with a new electrical supply company with headquarters in Sandusky. Mr. Bechstein is well known in the Middle West, having been continuously associated for the past twenty years with the Sandusky Gas & Electric Company and active in the public utility affairs of his state. During 1916-17 he served as president of the Ohio Electric Light Association.

**George E. Quinan** now holds the position of chief electrical engineer for the Puget Sound Traction, Light & Power Company, Seattle, Wash., a post which is new for that company. Mr. Quinan has heretofore been electrical engineer of the Seattle division, and previous to that he was made superintendent of light and power as successor to W. J. Grambs when the latter was promoted to the position of assistant to the president in the early part of 1914. S. C. Lindsay, who has been assistant engineer of the Seattle division, succeeds Mr. Quinan as electrical engineer of that division.

**George W. Hubley** has recently terminated his office as administrative engineer and chief of conservation of the United States Fuel Administration of Kentucky and opened an office in Louisville as a consulting and advisory engineer and also to furnish service as a power-plant specialist. Previously Mr. Hubley was general manager of the Badenhausen Company of Philadelphia and New York City, and prior to that he had been general manager and chief engineer of the Merchants' Heat & Light Company of Indianapolis, Ind. Subsequent to his employment with the Westinghouse Electric & Manufacturing Company and with the Citizens' Traction Company of Pittsburgh, Pa., he was for twenty years chief engineer and superintendent of the old Louisville (Ky.) Lighting Company and its successor, the Louisville Gas & Electric Company. He resigned from this company to join the electrical engineering staff of the Jones & Laughlin Steel Company of Pittsburgh, from which he resigned in 1916 to become associated with the Merchants' Heat & Light Company of Indianapolis.

**W. J. Grambs,** heretofore assistant to the president of the Puget Sound Traction, Light & Power Company, Seattle, Wash., has been made manager of auxiliary operations under a new reorganization plan of the personnel

W. J. GRAMBS

of that company. The auxiliary operations department includes the following subsidiary companies: Diamond Ice Company, Renton Coal Company and Washington Auto Bus Company. The position Mr. Grambs now holds has been lately created. Until recently he had served as supervisor of the Sea Training Bureau of the United States Shipping Board for the Pacific Northwest. Mr. Grambs' entrance into the electrical field dates back to the spring of 1888, when he established the Northwest Electric Supply & Construction Company. This company installed the first incandescent electric lighting plant in the Northwest and represented a number of prominent electrical manufacturing companies. In 1899 Mr. Grambs resigned from the company to become purchasing agent for the Seattle Electric Company. In 1905 he was appointed contract agent for the company and two years later sales manager. In 1911 he was made superintendent of light and power and advanced to the position of assistant to the president of the company in the early part of 1914.

## Obituary

**Charles H. Stevens,** for the past fifteen years head of the power sales department of the Lynn (Mass.) Gas & Electric Company, died at his residence in Lynn on April 26. He was born at Fort Fairfield, Me., fifty-three years ago and was widely known in New England central-station circles. He was actively interested in the work of the New England Section, N. E. L. A.

**Welcome I. Capen,** vice-president of the Postal Telegraph Company since 1912, died April 17 at his home in Mount Vernon, N. Y., at the age of sixty-five. Mr. Capen was first associated with the Vermont, Boston & Montreal Telegraph Company at Brattleboro, Vt. When the Postal Company was formed in 1885 he took charge of its Cincinnati office and later became general superintendent of the Western division. In 1909 he went to New York as general superintendent of construction and was made vice-president in 1912.

**Samuel E. P. Smith,** formerly general manager of the Reading Transit & Light Company, Reading, Pa., died on March 24 at his home in Reading after an illness of several months. Early last November Mr. Smith was appointed general manager of the Mobile Light & Railroad Company, Mobile, Ala. On Nov. 23 he was taken ill and soon returned to Reading. For more than ten years Mr. Smith was associated with the Reading Transit & Light Company, and in later years in the capacity of general manager. He was forty-two years old.

**A. D. Juilliard,** one of the pioneers in electric lighting in New York City, died of pneumonia on April 25, at the age of seventy. He was of French extraction, born at Canton, Ohio, and a father of the dry-goods commission business in New York, in which he was a leading figure up to the time of his death. He was actively connected with the introduction and development of the Brush and Swan electric lighting systems in New York City in the early eighties, having among his associates George W. Stockler and W. L. Strong, afterward Mayor of the city. He was vice-president and director of both the old Brush Electric Illuminating Company of New York and the Brush-Swan Electric Light Company of New England. Although immersed in insurance and railway affairs and in Republican politics, he gave a great deal of time and attention to these companies and other electrical interests, which later became merged into the great public utility, the New York Edison Company, now serving Manhattan Island as a whole. To Mr. Juilliard, a man of most engaging personality, high public spirit and a culture manifested in his long and generous support of opera in New York, the electrical industry owes not a little for his far-sighted financial support at a time when it was but a weak and struggling enterprise.

# TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

## JOBBERS PROTEST AGAINST SHORT DISCOUNTS ON DEVICES

### While Most Sales Are Now Direct, Still Many Eastern Houses Stock and Catalog Soldering Irons, Particularly, Which They May Discontinue

Electrical supply jobbers, particularly in the big industrial centers in the East, disapprove of the recent action of short-listing industrial heating devices, reported in last week's issue of the ELECTRICAL WORLD. The 10 per cent margin, it was pretty generally felt, was insufficient to warrant the jobbers stocking the devices, cataloging them or otherwise trying to interest buyers. It was stated by a number of jobbers that if no greater margin were allowed they would cease to handle these lines. Some took the position that the volume of business handled was too small to justify any serious objections.

It is recognized by the jobbers that the bulk of these articles are sold direct by the manufacturer. However, there are many jobbers who stock these goods and catalog them, particularly soldering devices. One Pittsburgh jobber states that he regards soldering irons as standard shelf goods which have been stocked for immediate delivery from the warehouse.

A Syracuse jobber says: "Our sales of these devices have been substantial, and considerable sales effort has been placed by us in the past on these lines, but, on the basis of the profit now allowed us, we will have to discontinue absolutely taking any initiative in pushing them.

"Out of Syracuse alone, with a population of 150,000, approximately thirty-five electrical salesmen go continuously and call with regularity on the other classes of purchasers who would buy such articles as are in the mentioned schedule, and it seems to us that this activity alone, which cannot be duplicated by the manufacturer, is worth more than the profit now provided."

Jobbers in New York City and New Jersey have been quite a factor in the distribution of soldering irons in the past year or so. Orders from jobbers for twenty-five soldering irons for stock have not been infrequent.

One large New England house estimates that its annual sale of soldering irons, glue pots and small industrial heating devices is from $2,000 to $3,000 per year; another good-sized house estimates $1,000 as an outside figure, and the smaller houses run downward to under $500. Heaters over 660 watts, and notably hotel toasters, are not carried in sizable stocks, as the business in such equipment is generally special as to requirements. One house carries one hotel toaster largely for emergencies, and another carries one large combination toaster and broiler for hotel service.

Despite the foregoing fact the jobbers are of the opinion that the field for commercial exploitation in industrial heating devices is very large and should be cultivated with the coöperation of manufacturer and jobber on a basis which will yield the latter a reasonable profit on his outlay and efforts. The sale of small hot plates to industrial plants for warming employees' lunches, etc., is increasing very rapidly, owing to a recent Massachusetts law requiring such installations. The automobile trade is becoming interested in electric soldering irons, one concern recently having purchased thirteen on one order from a Boston jobber.

In soldering irons, particularly, there are reasons to believe that the elimination of the jobbers by not allowing a larger discount will result in smaller sales than would otherwise be obtained. The jobbers have representatives going to industrial plants much more frequently than the manufacturers could expect to visit there, besides having a point of contact through long and satisfactory business relationship.

## THE MARKET FOR RADIO SUPPLIES IS AWAKENING

### Considerable Development Made in Past Two Years— Existing Conditions Point to a Greatly Increased Demand

Restrictions were removed on April 15 by the Navy Department from amateur, technical and experimental receiving stations. Commercial stations, however, are not free yet to receive messages.

By this action there is immediately opened a market for small wireless sets. This market will be greatly increased as soon as the ban on sending is removed. Already the buying has become large. In 1914 the sale of wireless material amounted to $672,575. Since the spring of 1917 virtually the entire sale of this material has been on government account. Much of this material during the war was made by factories that had not previously been in this field. These factories are now in a position to enter the commercial field provided that a satisfactory demand arises.

On this point it would be reasonable to expect a larger commercial demand than ever before. The ranks of amateurs have been greatly increased by the men who have learned radio work while in service. Air transportation is now virtually assured, and the air and ground requirements in this connection will not be small. Technical schools, with the start gained during the war, are undoubtedly going to take more interest in radio work than they did five years ago. Besides all of these there are the commercial and government wireless stations, of which the number is rapidly growing.

Since the war a great many developments have been made in apparatus. Prices of sets and accessories have advanced 10 to 15 per cent over pre-war prices.

## SCHEDULE MATERIAL OUTPUT 60 PER CENT OF NORMAL

### Both Jobbers and Manufacturers Disinclined to Stock Heavily, Although Latter Are Building Up Stocks to Meet Demands for Immediate Shipments

Inquiry among representative manufacturers of schedule material indicates that about 60 per cent of the normal output is being produced at the factory at present. Jobbers are quite generally content to let the manufacturer do the principal stocking up. Makers of wiring devices are largely of the opinion that prices will remain firm for months to come, probably well into the fall at least. They do not share the opinion expressed in some jobbing circles that prices do not warrant buying for stock, and in some cases are not slow to affirm that if any considerable expansion in building occurs, some of the jobbers will lose more through holding back on purchases than they will gain by waiting.

Increased buying for stock by the jobbers would tend to stabilize production conditions at the factories, and it

is believed that a reasonably wide distribution of finished material can be accomplished without overloading the jobber. The contractors are getting more work now, and house-wiring campaigns are running at full blast among the progressive central stations. New building operations are far from being at a standstill, though nothing like a boom is yet apparent. The natural demands of public consumption are responsible for a very fair volume of business, which seems likely to increase rather than to diminish.

Jobbers' stocks, so far as can be learned, are ample to meet immediate requirements, with perhaps enough surplus to carry their customers along for a very few weeks, and the question as to which interest shall maintain the principal stocks is unsettled. It looks as if the jobber would do well to see to it that his stock is complete and ample to meet daily anticipated demands, that hesitation on account of prices will get him nowhere, but that, on the other hand, he can reasonably count upon the manufacturer to supply the excess needs of the year without much danger of unsatisfactory deliveries. Manufacturers' stocks are being gradually built up to meet demands for immediate shipment of standard lines, and it is significant that many of these shipments are being made by express to the jobbing houses, although the freight embargoes are a memory. If the jobber is disinclined to overstock. the manufacturer is equally opposed to heavy accumulations of finished material at this time.

## METAL MARKET SITUATION

### Extreme Dullness Prevails in All Metals—Copper Slightly Higher

Less copper was purchased in April than in March. The past week's sales were very low, but there is still a confident feeling prevailing among producing interests. Slight increases of ¼ cent in Prime Lake and electrolytic have had no effect on the buying because the consumer is not at present interested in prices. Wire mills are about the only buyers of copper just now.

Government stocks are causing no apprehension, as their division among producers has been of such a nature as to place no great burden on any of them.

Director-General Hines has accepted the offer of the Industrial Board to bring together representatives of the Railroad Administration and the steel producers again to discuss the price stabilization plan.

The whole metal situation is quiet. Antimony and aluminum are slightly higher in price but non-active. The used metal market showed a small business this past week, but prices remained fixed. Large offerings of government material are added to large accumulations of surplus stocks of rolling mills and brass works.

### NEW YORK METAL MARKET PRICES

| | April 22 | April 29 |
|---|---|---|
| Copper: | £ s d | £ s d |
| London, standard spot | 76 10 0 | 76 15 0 |
| | Cents per Pound | Cents per Poun |
| Prime Lake | 15.50 | 15.62½ |
| Electrolytic | 15.25 | 15.37½ |
| Casting | 15.00 | 15.00 |
| Wire base | 17.25 to 18.00 | 17.25 to 18.00 |
| Lead, trust price | 5.00 | 5.00 |
| Antimony | 6.75 | 7.00 |
| Nickel, ingot | 40.00 | 40.00 |
| Sheet zinc, f. o. b. smelter | 10.00 | 10.00 |
| Spelter, spot | 6.40 | 6.42½ |
| Tin | Govt. price 72.50 | Govt. price 72.50 |
| Aluminum, 98 to 99 per cent | 31.00 | 31.00 to 33.00 |

### OLD METALS

| | Cents per Pound | Cents per Pound |
|---|---|---|
| Heavy copper and wire | 13.50 to 13.75 | 13.50 to 13.75 |
| Brass, heavy | 7.50 to 8.00 | 7.50 to 8.00 |
| Brass, light | 6.50 to 7.00 | 6.50 to 7.00 |
| Lead, heavy | 4.00 to 4.25 | 4.00 to 4.25 |
| Zinc, old scrap | 4.25 to 4.50 | 4.25 to 4.50 |

# THE WEEK
## IN TRADE

REPORTS of an increasing volume of business from virtually all sources come from almost all parts of the country. Apparatus sales, particularly in the East, are better. Motors are in greater demand and in many instances cheaper. More lines are going up, and inquiries are now in the market for equipment for a couple of 100-mile lines, one in the East and the other located on the Pacific Coast.

It is interesting to note that one prominent manufacturing concern is quoting prices on large waterwheels around one dollar per horsepower lower than pre-war prices.

Sales of surplus electrical equipment by the War Department up to April 11 amounted to $198,285.

Certain factors, such as uncertainty over iron and steel prices, the Victory Liberty Loan and the wait until peace shall be signed, are proving to be substantial handicaps to building and business generally. As soon as these are disposed of an excellent volume of business is expected to follow.

Labor is becoming scarce in certain regions, particularly the automobile centers and the farm country of the South and Northwest. Non-employment is generally decreasing and wage disputes are fewer.

## NEW YORK

There is a continued steady but slow increase in business. This is not restricted to any one class of electrical material but is general. Power cable is showing increased activity for street-lighting and power work. This implies no boom but a resumption in the use of power. Motor activity is on the increase. Practically every line of material is running just a little bit better than heretofore.

Jobbers find business holding well. No big bursts of buying have been reported. Much of the buying is small in value, although the number of orders is rather high. Prices are steady with no evidence of marked decline. Deliveries are good and jobbers' stocks are ample to care for immediate needs. Collections from retailers are continuing satisfactory, and some are close to thirty days. Longer time is required to clear up many contractors' accounts as some of the latter wait for their own payments before settling with the jobbers.

Building activity is increasing in the Queens district with the projection of several large industrials. Housing plans call for many dwellings. The home-building and house-wiring campaigns are bringing results in many sections of the East.

**SCHEDULE MATERIAL.**—Jobbers' stocks are in good shape. The demand shows a slight increase, much of which is for house wiring in the suburbs. The market also continues fair in the making over of private houses into small apartment dwellings.

**POWER CABLE.**—Many inquiries are being received and orders are gradually increasing to the extent that manufacturers who have found hard sledding this spring are beginning to see daylight ahead.

**MOTORS.**—In the fractional sizes and up to 5 hp. the market has been found quite active. Some manufacturers are having difficulty in keeping deliveries up to required demand for appliance use. Low-speed motors for sewing-machine group drive have been reported active following the settlement of labor conditions in the garment industries. Several new factories about to be built in the metropolitan district will offer an outlet for a thousand or two horsepower in the large sizes.

**STEEL POLES.**—Some activity has been reported in the market for steel poles for street lighting and for trans-

mission lines. One type of pole decreased in price about $7 per ton with the drop in steel prices five weeks ago.

**INSULATORS.**—The market for transmission-line insulators is picking up.

**STORAGE BATTERIES.**—Factories are still working practically to capacity taking care of back orders and catching up on new business brought in through automobile and farm-lighting activities. Large stocks of raw materials are being carried and deliveries are being made according to schedule.

**RUBBER-COVERED WIRE.**—One producer has changed from 22-cent to 20-cent base, bringing the average base just under 20 cents. One producer is on 18 cents, one on 19 cents, eight on 20 cents, one on 22 cents and one is quoting on a cost basis.

**WATERWHEELS.**—Quotations received within the past few days on a large wheel ranged from $5 to $8 per horsepower. The lower figure is under the previous price, while the higher figure is slightly above the current market. The successful bidder quoted between $6.50 and $7 per horsepower. This figure is lower than October quotations.

## CHICAGO

Export trade has been a live subject in Chicago business circles this week. Two factors have contributed to this interest. One is the meeting of the National Foreign Trade Council, and the other is an announcement by the members of the banking committee of the Mississippi Valley Association to the effect that the details of a banking institution to be operated by the organization are being planned.

There is somewhat of a feeling of depression in local utility circles because the Public Utilities Commission of Illinois refused to grant an increased fare to the Chicago surface lines. The decision handed down April 26 holds the fare at 5 cents.

Jobbers report that business in appliances continues good and that building materials are beginning to move. Building permits for the week ended April 19 totaled ninety-three, covering 123 buildings, with a total value of $1,261,400. For the week ended April 26 155 building permits were issued, valued at $1,703,900.

**SOCKETS.**—Jobbers have made a reduction of about 20 per cent on their prices for sockets, although there has been no decrease in the manufacturers' price to the jobber on these devices.

**CONDUIT FITTINGS.**—The market is beginning to show signs of life again.

**MOTORS.**—One manufacturer of direct-current motors running from ¼ hp. to 25 hp. in size reports that his business now is practically as good as it was in war time. His factory is still working at full production.

**COPPER WIRE.**—Rubber-covered and weatherproof copper wire still remain on a 20-cent base. Prices of $9 per 1000 ft. are being quoted on large quantities.

**CONDUIT.**—The market is a trifle more active than it was last week.

**DOMESTIC APPLIANCES.**—In reviewing the general market situation on domestic appliances since the first of the year, one manufacturer said that 1919 bids fair to surpass any year in the history of the business. The Commonwealth Edison Company's retail stores are showing a nice increase over previous records, the jobbing accounts are more active, and the central stations in some of the surrounding states are busy with merchandising endeavors. The activity includes practically all lines of heating devices. Stocks of the retail stores were very badly depleted by the big Christmas business, and there has been considerable buying to replenish these stocks. It may be said that the business is better from a wholesale standpoint than from a retail standpoint, except in Chicago. As this manufacturer sees the price situation, there will be no real change in the level of prices before September.

**INSTRUMENTS.**—One manufacturer of electrical instruments reports that the volume of his business for the first week in April exceeded the total volume of business for the entire month of April last year. The majority of sales are being made to central-station customers.

**POLES.**—Cedar-pole producers are receiving orders in satisfactory volume.

## BOSTON

Trade was still considerably unsettled last week by the prolongation of the telephone strike until Monday afternoon and by a general holiday Friday in honor of the parade of the Twenty-sixth Division in this city. Business was resumed last Monday in fair volume. The demand for washing machines and vacuum cleaners continues to increase, and some factory representatives report that production is on a day and night basis. The shortage of armored flexible conduit shows signs of passing. Prices are running about even with last week's quotations, although some weakness is reported on dry batteries under close competition. Stocks are rather uneven, and a good deal of hand-to-mouth buying is still in evidence. The demand for electrical accessories for automobile use is remarkably good. Deliveries are very satisfactory. Collections are a little slow, with small prospect of improvement until the Victory Liberty Loan is completed. Building projects are still slow in materializing, although a good deal of small betterment work is under way.

**MOTORS.**—Interest is quickening somewhat and stocks are in good shape for prompt deliveries. A better tone has been noted in the market during the past fortnight. Prices are a little unsteady, though no marked changes are predicted in the trade for the immediate future. A 10 per cent reduction on Wagner single-phase motors has been reported.

**FARM-LIGHTING SETS.**—The first quarter of 1919 exceeded the corresponding period of 1918 in the volume of business done by one large distributer. Inquiries are coming in well and an excellent year's sales is expected. Prices are expected to remain steady throughout 1919. The demand from Connecticut and from the Canadian Provinces is said to be gratifying at this time. The increased price of these sets compared with a year or two ago does not seem to deter buyers seriously.

**LAMPS.**—Trade holds up better than ordinarily would be expected. Jobbers' stocks reflect improved deliveries in the smaller sizes, which hitherto have been somewhat behindhand in production.

**PORTABLE LAMPS.**—A surprisingly steady trade has been handled by retailers, and this business is fast developing into a year-round type. Very little price cutting has been required to move these products, even after the holiday trade ceased.

**WIRE.**—The feeling is strong that prices will advance before long. There is a fair demand at present for galvanized iron and steel guy wire for small construction jobs in the telephone field. Some purchases are also going through for fire-alarm circuit use.

**INSULATORS.**—Glass insulators show some tendency to weaken in price. Procelain insulators hold firm, and only a moderate amount of construction work on central-station lines is in sight at the moment. At the present price of copper it would seem that central stations might relax their conservatism more generally as regards extensions.

**SCHEDULE MATERIAL.**—Stocks are well prepared for an increased volume of trade. Barring numerous small jobs and occasional larger ones, the contractors are not in the market at the present time for a normal amount of material.

**STORAGE BATTERIES.**—Sales for automobile starting and lighting service are in excellent volume.

**WASHING MACHINES.**—The New England market is absorbing these products about as fast as they can be shipped in. It is expected that sales of the larger jobbing houses will run into six-figure totals this year.

**HOT PLATES.**—A heavy demand is noted for factory service.

## ATLANTA

Trade in the wholesale and retail lines is better than at any time since the armistice. The textile situation, which affects this section, is now better than it has been in months. Following the recent improvement, this week brought news of a highly encouraging nature, and there is unanimity of opinion that the gain will continue. A number of new textile mills are being organized in Georgia, North and South Carolina, calling for considerable quantities of electrical equipment. Atlanta voted this week against a municipal electric plant.

APPARATUS.—After a protracted period of dullness following the armistice, heavy equipment is again beginning to pick up. Manufacturers report increasing inquiries and numerous proposals are being made. The outlook for turbine business is especially bright. The small central stations and municipal plants are getting ready to install more generating capacity. This is evidenced by the fact that actual orders show a decided gain and that the municipalities are getting in better shape financially to consider enlargements and improvements. Then, too, there is a potential business in the larger central-station field awaiting the end of the present period of financial difficulties. A larger business is also expected from industrial sources as soon as production conditions approach more nearly to normal ones. No change in turbine prices has been noted since the January adjustment. Better promises of shipment are being made and deliveries are reasonable.

CONDUIT.—The demand for the black and white rigid products compared with last week shows little change, excepting an increase in scattered purchases from jobbers for industrial work. Stocks in general are in good shape and prompt factory shipments can be made for substantial requirements. Dealers and contractors anticipate a large volume of business from now on, when construction under way advances. Prices are steady and no weakness is evident. Favored jobbers, however, buying in large quantities, are receiving the benefit of an extra 5 per cent discount.

MOTORS.—A big improvement is noted in the number of inquiries received and orders actually placed. Capacities up to 50 hp. are moving briskly, and the larger capacities between 50 hp. and 100 hp. show marked gains over the previous weeks. Activity is accounted for to some extent by better central-station conditions, and rate increases are reflected in an improved financial outlook. Industrials are gradually returning to a normal working basis. There have been no price changes lately; stocks are ample and factory deliveries good.

PANELBOARDS.—These have shown little life this week, registering a decline in sales over the past two weeks. This condition is spotty, however, as one manufacturer reports a number of inquiries which will materialize in a satisfactory volume of orders within a few days. The class of buildings that stimulate this item is being rapidly pushed, and a good trade is looked for. Local stocks are in poor condition, and factory facilities, while improving, are far from normal. Prices remain firm.

FLEXIBLE-STEEL CONDUIT.—Eastern shipments are excellent, and stocks on hand appear to be ample to take care of the increasing demand. Manufacturers and jobbers report a brisk movement to all points and steady prices.

## SEATTLE—PORTLAND

Big business interests report some revival of activity in various branches of industry during the past week. This is notably true of the building industry as reflected by the large increase in the number of permits issued for both business structures and residences. The great majority of Northwestern cities record gains in building over the previous month and many for the year to date over the same period last year. Seattle has not entirely recovered from the effects of the seven weeks' shipyard strike, but evidences are accumulating that the summer is to be an active period. The smaller cities in eastern Washington and throughout Oregon will from present indications experience a year in building similar to some of the best years previous to the war. Seattle jobbers report the volume of business as slow and sluggish. During the week sales to shipyards and industrials were light.

Domestic-science business showed a slight increase. Inquiries for electrical equipment for lumber mills in the Puget Sound district continue to come in but orders are not following. The Railroad Administration has placed orders with Northwestern lumber mills for 2,000,000 ties, valued at $1,750,000. The Puget Sound Navy Yard reports receipt of a contract for a three-million-dollar repair ship, work to begin immediately. Construction of the Skagit River power plant by the city of Seattle along lines suggested by City Engineer A. H. Dimeck has been declared feasible by consulting engineers. The cost of the project is estimated at $30,000,000 with a capacity of 300,000 hp. The cost of the first unit, for which bonds have been sold, is estimated at $500,000.

Portland electrical jobbers and manufacturers report business for the past week as exceptionally light. A small increase in all copper wire is noted. Other prices show no change. A number of mills in Coos Bay region are expecting to electrify shortly or to add additional electrical equipment. A decided increase in construction during the past month has been noted, permits varying from medium-priced residences to substantial brick and concrete garages. Portland has been making steady improvement along building lines since the first of the year.

## SAN FRANCISCO

This is Pacific Coast convention week at Santa Barbara, where the National Electric Light Association, contractor-dealers' and jobbers' associations of this district meet. It is expected that business will show a further temporary stagnancy because of the Victory Liberty Loan campaign.

The effort of San Francisco to improve her foreign trade is reflected in the securing of the 1920 convention of foreign trade delegates for this city.

TRANSFORMERS.—Commercial sizes of standard transformers have recently advanced 10 per cent. Deliveries are fair, but great quantities will be required if the range campaign now being inaugurated is successful. It is recalled in this connection that a similar campaign several years ago was ruined by inability to secure transformers.

LINE MATERIAL.—Barring a 10 per cent advance in certain bolts and braces about two months ago, there has been no recent change; stocks are good. Observers predict that needed new construction and extensions must surely be made this year—now that the power companies have the money and load to carry them out—which will restore the business on this class of material to the standing that it had about five years ago.

VIBRATORS.—The demand is still very heavy. Deliveries are poor.

SEWING MACHINES.—Deliveries are still a little slow on certain makes. Extensive national advertising is resulting in the booking of advance orders.

WIRE AND CABLE.—Rubber-covered wire in the standard commercial sizes has been unusually steady during the last few weeks, there having occurred only a nominal increase. Lamp cord, on the contrary, has decreased all along the line by an average of 10 per cent, a considerable drop bearing in mind the comparatively small part that the copper factor plays in its price. Demands in both these staples have been light, although a boom in lamp cord, especially, is predicted. Lead-covered cable, on the contrary, has jumped 20 per cent in the regular wiring sizes, such as Nos. 14 and 12.

BELLS AND BUZZERS.—Because of the labor cost, bells and buzzers have recently advanced 10 per cent. The demand is average and the stocks high.

CONDUIT AND FITTINGS.—Several fairly large inquiries are reported for municipal and government work. Eastern shipments maintain their schedules fairly well. Flexible steel-armored conductor has increased 15 per cent.

# Current Prices of Electrical Supplies

## *New York and Chicago Quotations*

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges or account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit.

Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

### ARMORED CONDUCTOR, FLEXIBLE STEEL

*Single-Conductor*

| B. & S. Size | List per 1000 Ft. |
|---|---|
| No. 14 solid | $61.00 |
| No. 12 solid | 71.00 |
| No. 10 solid | 90.00 |
| No. 8 solid | 106.00 |
| No. 6 solid | 145.00 |
| No. 10 stranded | 95.00 |
| No. 8 stranded | 115.00 |
| No. 6 stranded | 160.00 |
| No. 4 stranded | 205.00 |
| No. 2 stranded | 266.00 |
| No. 1 stranded | 315.00 |

*Twin-Conductor*

| | |
|---|---|
| No. 14 solid | 104.00 |
| No. 12 solid | 135.00 |
| No. 10 solid | 185.00 |
| No. 8 stranded | 235.00 |
| No. 6 stranded | 370.00 |
| No. 4 stranded | 575.00 |

### NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

*Single-Conductor*

| | No. 14 Solid |
|---|---|
| Less than coil | +10% to 20% |
| Coil to 1000 ft | List to 25% |
| | **No. 12 Solid** |
| Less than coil | +10% to 20% |
| Coil to 1000 ft | List to 25% |

*Twin-Conductor*

| | No. 14 Solid |
|---|---|
| Less than coil | +10% to 20% |
| Coil to 1000 ft | List to 25% |
| | **No. 12 Solid** |
| Less than coil | +10% to 20% |
| Coil to 1000 ft | List to 25% |

### DISCOUNT—CHICAGO

*Single-Conductor*

| | No. 14 Solid |
|---|---|
| Less than coil | +20% |
| Coil to 1000 ft | List |
| | **No. 12 Solid** |
| Less than coil | +20% |
| Coil to 1000 ft | List |

*Twin-Conductor*

| | No. 14 Solid |
|---|---|
| Less than coil | $115.00 |
| Coil to 1000 ft | 100.00 |
| | **No. 12 Solid** |
| Less than coil | +20% |
| Coil to 1000 ft | List |

### ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

| | |
|---|---|
| Less than 1/5 std. pkg | +20% |
| 1/5 to std. pkg | List |
| Std. pkg | 15% |

DISCOUNT—CHICAGO

| | |
|---|---|
| Less than 1/5 std. pkg | +30% to List |
| 1/5 to std. pkg | +5% to 20% |
| Std. pkg | 18% to 36% |

### BATTERIES, DRY

NEW YORK

| Each Net | No. 6 Regular | No. 6 Ignitor |
|---|---|---|
| Less than 12 | $0.45—$0.46 | $0.45—$0.47 |
| 12 to 50 | .40 | .40— .41 |
| 50 to barrel | .35— .36 | .36— .37 |
| Barrel lots | .32— .329 | .33— .339 |

### BATTERIES, DRY—Continued

CHICAGO

| Each Net | No. 6 Regular | No. 6 Ignitor |
|---|---|---|
| Less than 12 | $0.45 | $0.45 |
| 12 to 50 | .38 | .38 to $0.39 |
| 50 to barrel | .35 to $0.362 | .35 to .372 |
| Barrel lots | .326 to .332 | .326 to .342 |

### CONDUIT, METALLIC FLEXIBLE

| Size, In. | Ft. per Coil | List per 100 Ft. |
|---|---|---|
| ⅜ | 250 | $5.00 |
| ½ | 250 | 7.50 |
| ¾ | 100 | 10.00 |
| 1 | 50 | 13.00 |
| 1 | 50 | 21.00 |
| 1¼ | 50 | 26.00 |
| 1½ | 25–50 | 35.00 |
| 2 | 25–50 | 45.00 |
| 2½ | 25–50 | 52.00 |

### NET PER 1000 FT.—NEW YORK

| | Less than Coil | Coil to 1000 Ft. |
|---|---|---|
| ⅜-in. single trip | $75.00 | $63.75— 69.75 |
| ⅜-in. double strip | 75.00— 82.50 | 72.00— 75.00 |
| ½-in. single strip | 100.00 | 85.00— 93.00 |
| ½-in. double strip | 100.00—110.00 | 96.00—100.00 |

### NET PER 1000 FT.—CHICAGO

| | Less than Coil | Coil to 1000 Ft. |
|---|---|---|
| ⅜-in. single strip | $75.00 | $63.25 to $63.75 |
| ⅜-in. double strip | 78.25 to $78.75 | 71.25 |
| ½-in. single strip | 100.00 | 75.00 to 85.00 |
| ½-in. double strip | 105.00 | 93.00 to 95.00 |

### CONDUIT, NON-METALLIC FLEXIBLE

| Size, In. | List per Foot | Size, In. | List per Foot |
|---|---|---|---|
| ⅜ | $0.05½ | 1 | $0.25 |
| ½ | .06 | 1¼ | .33 |
| ¾ | .09 | 1½ | .40 |
| ¾ | .12 | 1¾ | .47 |
| ¾ | .15 | 2 | .55 |
| ¾ | .18 | 2¼ | .65 |

### NET PER 1000 FT.—NEW YORK

| | Less than $15 List | $15 to $60 List | $60 to $150 List |
|---|---|---|---|
| ⅜-in.— | $25.00 | $18.00 | $16.00 |
| ½-in.— | 30.00 | 19.50 | 17.50 |

### NET PER 1000 FT.—CHICAGO

| | Less than $15 List | $15 to $60 List | $60 to $150 List |
|---|---|---|---|
| ⅜-in.— | $60.00 | $30.00 | $26.00–26.50 |
| ½-in.— | 65.00 | 32.00–32.50 | 29.00 |

### CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

*Card No.* 40

| Size, In. | Conduit, List per Foot |
|---|---|
| ⅜ | $0.08½ |
| ½ | .08½ |
| ¾ | .08½ |
| ¾ | .11½ |
| 1 | .17 |
| 1¼ | .23 |
| 1½ | .27½ |
| 2 | .37½ |
| 2½ | .58½ |
| 3 | 76½ |

### CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

| Size, In. | Couplings, List | Elbows, List |
|---|---|---|
| ⅛ | $0.05 | $0.19 |
| ¼ | .06 | .19 |
| ⅜ | .07 | .19 |
| ½ | .10 | .25 |
| ¾ | .13 | .37 |
| 1 | .17 | .45 |
| 1¼ | .21 | .50 |
| 1½ | .28 | 1.10 |
| 2 | .40 | 1.80 |
| 2½ | .60 | 4.80 |

DISCOUNT—NEW YORK

| | ⅛ in. to ½ in. | ¾ in. to 3 in. |
|---|---|---|
| Less than 2500 lb. | 4% to 12.1% | 6% to 14.1% |
| 2500 to 5000 lb. | 9% to 15.1% | 11% to 17.1% |

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

| | ⅛ to ½ In. | ¾ to 3 In. |
|---|---|---|
| Less than 2500 lb. | +3% | +1% to 2% |
| 2500 to 5000 lb. | +1% to 2% | +4% |

(For galvanized deduct six points from above discounts.)

### FLATIRONS

NEW YORK

| | |
|---|---|
| List price | $7.00 to $7.50 |
| Discount | 25% |

CHICAGO

| | |
|---|---|
| List price | $6.35 to $7.50 |
| Discount | 20% to 30% |

### FUSES, INCLOSED

| 250-Volt | Std. Pkg. | List |
|---|---|---|
| 3-amp. to 30-amp. | 100 | $0.25 |
| 35-amp. to 60-amp. | 100 | .35 |
| 65-amp. to 100-amp. | 50 | .90 |
| 110-amp. to 200-amp. | 25 | 2.00 |
| 225-amp. to 400-amp. | 25 | 3.60 |
| 450-amp. to 600-amp. | 10 | 5.50 |
| **600-Volt** | | |
| 3-amp. to 30-amp. | 100 | $0.40 |
| 35-amp. to 60-amp. | 100 | .60 |
| 65-amp. to 100-amp. | 50 | 1.50 |
| 110-amp. to 200-amp. | 25 | 2.50 |
| 225-amp. to 400-amp. | 25 | 5.50 |
| 450-amp. to 600-amp. | 10 | 8.00 |

DISCOUNT—NEW YORK

| | |
|---|---|
| Less than 1/5 std. pkg | 30% |
| 1/5 to std. pkg | 41% |

DISCOUNT—CHICAGO

| | |
|---|---|
| Less than 1/5 std. pkg | 30% |
| 1/5 to std. pkg | 40% to 41% |

### FUSE PLUGS

*3-Amp. to 30-Amp.*

NEW YORK

| | Per 100 Net |
|---|---|
| Less than 1/5 std. pkg | $6.00 to $8.75 |
| 1/5 to std. pkg | 5.50 to 7.00 |

Standard packages, 500. List, each, $0.07

CHICAGO

| | Per 100 Net |
|---|---|
| Less than 1/5 std. pkg | $8.00 |
| 1/5 to std. pkg | 7.00 |

Standard packages, 500. List each, $0.07

## LAMPS, MAZDA OR TUNGSTEN

*110 to 125 Volts*

| Regular, Clear: | Std. Pkg. | List Each |
|---|---|---|
| 10 to 40-watt—B | 100 | $0.35 |
| 60-watt—B | 100 | .40 |
| 100-watt—B | 24 | .85 |
| 75-watt—C | 50 | .70 |
| 100-watt—C | 24 | 1.10 |
| 200-watt—C | 24 | 2.20 |
| 300-watt—C | 24 | 3.25 |
| Round Bulbs, 3½-in., Frosted | | |
| 15-watt—G 25 | 50 | .60 |
| 25-watt—G 25 | 50 | .60 |
| 40-watt—G 25 | 50 | .60 |
| Round Bulbs, 3½-in., Frosted: | | |
| 60-watt—G 30 | 24 | .82 |
| Round Bulbs, 4½-in., Frosted: | | |
| 100-watt—G 35 | 24 | 1.15 |

DISCOUNT—NEW YORK

| | |
|---|---|
| Less than std. pkg | List |
| Std. pkg | 10% |

DISCOUNT—CHICAGO

| | |
|---|---|
| Less than std. pkg | List |
| Std. pkg | 10% |

## LAMP CORD

*Cotton-Covered, Type C, No. 18*

NEW YORK

| | Per 1000 Ft. Net |
|---|---|
| Less than coil (250 ft.) | $35.01–$35.18 |
| Coil to 1000 ft | 25.94– 29.17 |

CHICAGO

| | Per 1000 Ft. Net |
|---|---|
| Less than coil (250 ft.) | $31.00—$36.00 |
| Coil to 1000 ft | 24.00— 27.00 |

## LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

| | |
|---|---|
| Net per 100 | $29.70 to $33.00 |

CHICAGO

| | |
|---|---|
| Net per 100 | $33.00 |

## OUTLET BOXES

| Nos. | List per 100 |
|---|---|
| 101—A, A 1½, 4 S.C., 6200, 320 | $30.00 |
| 102—B.A., 6200, S.E., 300, A.X., 1½, 4 S. | 30.00 |
| 103—C.A., 9, 4R, B 1½ | 25.00 |
| 106—F.A., 7, C.S., 1½, 3 R | 20.00 |

DISCOUNT—NEW YORK

| | Black | Galvanized |
|---|---|---|
| Less than $10.00 list | 26%–36% | 20%–33% |
| $10.00 to $50.00 list | 36%–47% | 31%–43% |

DISCOUNT—CHICAGO

| | Black | Galvanized |
|---|---|---|
| Less than $10.00 list | 20%–32% | 10%–27% |
| $10.00 to $50.00 list | 30%–40% | 20%–35% |

## PIPE FITTINGS

DISCOUNT—NEW YORK

| | |
|---|---|
| Less than 1/5 std. pkg | 10% |
| 1/5 to std. pkg | 20% |
| Std. pkg | 30% |

DISCOUNT—CHICAGO

| | |
|---|---|
| Less than 1/5 std. pkg | 5% |
| 1/5 to std. pkg | 15% |
| Std. pkg | 25% |

## PORCELAIN CLEATS—UNGLAZED

*Two and Three Wire*

NEW YORK

| | Per 1000 Net |
|---|---|
| Less than 1/5 std. pkg | $15.00 to $22.40 |
| 1/5 to std. pkg | 12.00 to 15.35 |

Standard package, 2200. List per 1000, $21 to $34

CHICAGO

| | Per 1000 Net |
|---|---|
| Less than 1/5 std. pkg | $21.00–$24.15 |
| 1/5 to std. pkg | 17.85– 21.00 |

Standard package, 2200. List per 1000, $20.00

## PORCELAIN KNOBS

NEW YORK

| Per 1000 Net. | Std. Pkg. 3500. | Std. Pkg. 4000 5½ N.C.—Solid Nail-it—N.C. |
|---|---|---|
| Less than 1/5 std. pkg | $13.60–$15.00 | $22.00–$22.40 |
| 1/5 to std. pkg | 10.50– 11.20 | 15.35– 18.00 |

CHICAGO

| Per 1000 Net. | Std. Pkg. 3500. | Std. Pkg. 4000 5½ N.C.—Solid Nail-it—N.C. |
|---|---|---|
| Less than 1/5 std. pkg | $13.00–$18.40 | $32.00–$36.80 |
| 1/5 to std. pkg | 11.50– 16.00 | 27.20– 32.00 |

## SOCKETS AND RECEPTACLES

| | Std. Pkg. | List |
|---|---|---|
| ½-in. cap key and push sockets | 500 | $0.33 |
| ½-in. cap keyless socket | 500 | .30 |
| ½-in. cap pull socket | 250 | .60 |

DISCOUNT—NEW YORK

| | |
|---|---|
| Less than 1/5 std. pkg | +20% |
| 1/5 to std. pkg | List |

DISCOUNT—CHICAGO

| | |
|---|---|
| Less than 1/5 std. pkg | List |
| 1/5 std. pkg | List to 10% |

## SWITCHES, KNIFE

*250-Volt, Front Connections, No Fuse*

| | |
|---|---|
| High Grade: | |
| 30-amp. S. P. S. T | $0.80 |
| 60-amp. S. P. S. T | 1.20 |
| 100-amp. S. P. S. T | 2.25 |
| 200-amp. S. P. S. T | 3.48 |
| 300-amp. S. P. S. T | 5.34 |
| 30-amp. D. P. S. T | 1.20 |
| 60-amp. D. P. S. T | 1.78 |
| 100-amp. D. P. S. T | 3.38 |
| 200-amp. D. P. S. T | 5.20 |
| 300-amp. D. P. S. T | 8.00 |
| 30-qmp. 3 P. S. T | 1.80 |
| 60-amp. 3 P. S. T | 2.68 |
| 100-amp. 3 P. S. T | 5.08 |
| 200-amp. 3 P. S. T | 7.80 |
| 300-amp. 3 P. S. T | 12.00 |
| Low Grade: | |
| 30-amp. S. P. S. T | $0.42 |
| 60-amp. S. P. S. T | .74 |
| 100-amp. S. P. S. T | 1.50 |
| 200-amp. S. P. S. T | 2.70 |
| 30-amp. D. P. S. T | .68 |
| 60-amp. D. P. S. T | 1.22 |
| 100-amp. D. P. S. T | 2.50 |
| 200-amp. D. P. S. T | 4.50 |
| 30-amp. 3 P. S. T | 1.02 |
| 60-amp. 3 P. S. T | 1.84 |
| 100-amp. 3 P. S. T | 3.76 |
| 200-amp. 3 P. S. T | 6.76 |

DISCOUNT—NEW YORK

| | High Grade |
|---|---|
| Less than $10 list | +15% |
| $10 to $25 list | 2% |
| $25 to $50 list | 5% |
| | Low Grade |
| Less than $10 list | +5% |
| $10 to $25 list | 8% |
| $25 to $50 list | 15% |

DISCOUNT—CHICAGO

| | High Grade |
|---|---|
| Less than $10 list | +25%+15% |
| $10 to $25 list | +10% to 2% |
| $25 to $50 list | +5% to 5% |
| | Low Grade |
| Less than $10 list | +15% to +5% |
| $10 to $25 list | 2% to 8% |
| $25 to $50 list | 5% to 15% |

## SWITCHES, SNAP AND FLUSH

*5-Amp. and 10-Amp., 125-Volt Snap Switches*

| | Std. Pkg. | List |
|---|---|---|
| 5-amp. single-pole | 250 | $0.28 |
| 5-amp. single-pole, ind | 250 | .32 |
| 10-amp. single-pole | 100 | .48 |
| 10-amp. single-pole, ind | 100 | .54 |
| 5-amp. three-point | 100 | .54 |
| 10-amp. three-point | 50 | .76 |
| 10-amp., 250-volt, D. P | 100 | .66 |

*10-Amp., 250-Volt Push-Button Switches*

| | Std. Pkg. | List |
|---|---|---|
| 10-amp. single-pole | 100 | $0.45 |
| 10-amp. three-way | 50 | .70 |
| 10-amp. double-pole | 50 | .70 |

## SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

| | |
|---|---|
| Less than 1/5 std. pkg | +20% |
| 1/5 to std. pkg | List |
| Std. pkg | 15% to 17% |

DISCOUNT—CHICAGO

| | |
|---|---|
| Less than 1/5 std. pkg | +30% to list |
| 1/5 to std. pkg | +5% to 10% |
| Std. pkg | 8% to 18% |

## SWITCH BOXES, SECTIONAL CONDUIT

| Union and Similar— | List Each |
|---|---|
| No. 155 | $0.34 |
| No. 160 | .60 |

DISCOUNT—NEW YORK

| | Black | Galvanized |
|---|---|---|
| Less than $2.00 list | 18%–20% | List–18% |
| $2.00 to $10.00 list | 28%–30% | 5%–28% |
| $10.00 to $50.00 list | 45%–50% | 10%–47% |

DISCOUNT—CHICAGO

| | Galvanized | Black |
|---|---|---|
| Less than $2.00 list | 25% to 40% | 20% to 30% |
| $2.00 to $10.00 list | 25% to 50% | 20% to 40% |
| $10.00 to $50.00 list | 25% to 64% | 20% to 52% |

## TOASTERS, UPRIGHT

NEW YORK

| | |
|---|---|
| List price | $6.00 to $7.00 |
| Discount | 25% |

CHICAGO

| | |
|---|---|
| List price | $6.35 to $7.50 |
| Discount | 20% to 30% |

## WIRE, ANNUNCIATOR

NEW YORK

| | Per Lb. Net |
|---|---|
| No. 18, less than full spools | $0.39–$0.41 |
| No. 18, full spools | .35– .37 |

CHICAGO

| | Per Lb. Net |
|---|---|
| No. 18, less than full spools | $0.53 to $0.90 |
| No. 18, full spools | .47 to .64 |

## WIRE, RUBBER-COVERED, N. C.

*Solid-Conductor, Single-Braid*

NEW YORK

| | Price per 1000 Ft. Net | | |
|---|---|---|---|
| No. | Less than 500 Ft. | 500 to 1000 Ft. | 1000 to 5000 Ft. |
| 14 | $14.15–$14.50 | $10.50–$12.65 | $10.50–$10.60 |
| 12 | $18.18 | 18.18 | $13.64 |
| 10 | 24.30 | 24.30 | 16.20 |
| 8 | 33.12 | 27.60 | 22.08 |
| 6 | 52.50 | 43.75 | 35.00 |

CHICAGO

| | Price per 1000 Ft. Net | | |
|---|---|---|---|
| No. | Less than 500 Ft. | 500 to 2500 Ft. | 2500 to 5000 Ft. |
| 14 | $18.62–$20.00 | $13.00–$15.00 | $11.50–$13.00 |
| 12 | 17.50– 21.63 | 17.55– 21.63 | 17.55– 18.54 |
| 10 | 24.05– 28.91 | 24.05– 28.91 | 21.16– 24.78 |
| 8 | 33.35– 39.34 | 33.35– 33.72 | 29.35– 33.72 |
| 6 | 52.95– 61.74 | 46.60– 52.92 | 46.60– 52.92 |

## WIRE, WEATHERPROOF

*Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.*

NEW YORK

| | Per 100 Lb. Net |
|---|---|
| Less than 25 lb | $24.00–$29.25 |
| 25 to 50 lb | 24.00– 25.25 |
| 50 to 100 lb | 23.00– 23.25 |

CHICAGO

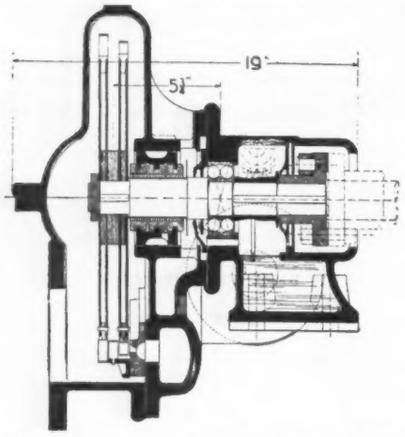
| | Per 100 Lb. Net |
|---|---|
| Less than 25 lb | $23.75 to $35.75 |
| 25 to 50 lb | 23.75 to 34.75 |
| 50 to 100 lb | 23.75 to 37.35 |

# NEW APPARATUS & APPLIANCES

## A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

### One-Bearing Steam Turbine

The outstanding feature of the "steam motor" manufactured by the Steam Motors Company, Springfield,




MOUNTED IN PLACE OF ONE BEARING OF DRIVEN UNIT

Mass., is that it is not a complete turbine in itself, but when connected to its driven member becomes an integral part of the complete unit, making possible a compact two-bearing unit with any standard design of driven apparatus. It consists of an overhung wheel supported by one S. K. F. ball bearing arranged so that it can be mounted in place of one bearing of the driven unit, such as a pump, blower, generator, etc., and attached to it by a rigid coupling. By this arrangement the weight of the overhung wheel balances the load on the driven unit shaft and allows a minimum deflection for each. A great saving in floor space and elimination of faulty alignment is thus effected.

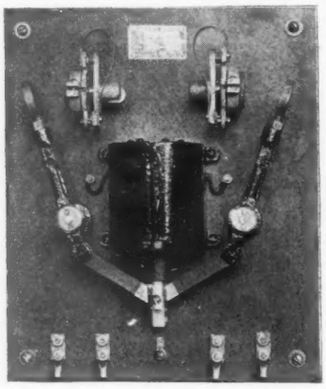
The principle of operation of the turbine proper is the straight two-row velocity-stage impulse turbine. Double labyrinth glands prevent an escape of steam and eliminate the necessity of adjustment or renewal of any soft packing. For generator drive and other applications when constant speed is required the motor is fitted with a centrifugal governor of the Pickering type, driven by gearing from the main shaft. An emergency governor can also be used if desired.

### Asbestos Insulation

Consisting of long fibrous white asbestos free from such impurities as lime, iron and alumina and cemented together with a special chemically neutral cement, "Rockbestos," a fire-resisting insulation for wires is announced by the Marlin-Rockwell Corporation of New Haven, Conn. Being mineral in its composition, it is said that disintegration, deterioration, drying-out or decay do not take place even after long service, while varying degrees of heat and cold do not affect it. In the form of a roving this insulation is evenly applied to the conductor in such a manner as to insure an adhesive, uniform homogeneous body of high insulating and dielectric strength. This insulation is said to possess great flexibility, mechanical strength and tenacity and to be proof against acid, alkali and moisture, in addition to its fire-repelling qualities.

### Two-Pole-Magnet Line Contactor

Particularly intended for elevator service or for frequent intermittent service where arcing conditions would quickly reduce the carrying capacity



USEFUL FOR ELEVATOR SERVICE

even of carefully constructed copper-to-copper contacts, the type SSAC-2-50 two-pole-magnet line contactor for 50-amp. service has been produced by the Automatic Switch Company of 4 White Street, New York City. It may be employed in the construction of controlling devices for polyphase motors, both as a line contactor and as a resistance bridging contactor in automatic starting devices.

### Bowls and Shades for Fixtures

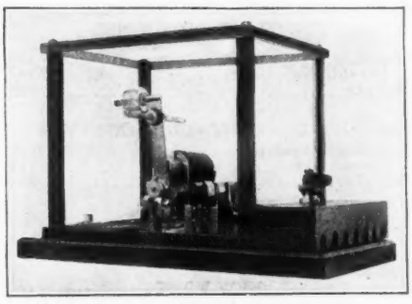
Bowls in popular sizes with shades to match, as well as lantern forms for use in halls, vestibules, etc., are included in a line of glassware for lighting fixtures recently brought out by the Beardslee Chandelier Manufacturing Company, 223 South Jefferson Street, Chicago. "Magnolia" white glass, with an external satin finish, is used in the manufacture of these designs.

### Wood-Boring Tool

A wood-boring tool that may be used in bit braces, breast drills or pneumatically and electrically driven machines will shortly be obtainable from the W. A. Ives Manufacturing Company, Wallingford, Conn. It is especially useful in electrical work to bore holes in timber for wires and conduits.

### Multiple-Circuit Sensitive Relay

A relay that operates on very small currents and yet has contacts that carry sufficient current to operate remote-control oil circuit breakers, field circuit breakers and blower motor-circuit breakers is being manufactured by Schweitzer & Conrad, 4431 Ravenswood Avenue, Chicago It is mounted on a slate base and is operated by the rotative action of two electromagnets upon an armature mounted between the two poles. Mounted upon the same shaft with the armature is an arm carrying an insulated contact-making rod which closes the control circuits when the relay operates. This arm is weighted in such a way that normally the weight is slightly beyond center so that very little energy is necessary to carry it past center and allow it to fall into the multiple contacts mounted on the slate base. The position of the weight is adjustable, thereby making the relay adaptable to a large range of operating currents. The insulated contact-making rod merely bridges the pair of contacts as it falls into position.



OPERATED BY ROTATIVE ACTION OF TWO ELECTROMAGNETS

The relay may also be used to protect generators and transformers of large rating. Arrangements are made

so that the glass cover with which the relay is provided can be locked in position over the outside terminals.

## Electric Lead-Burning Set

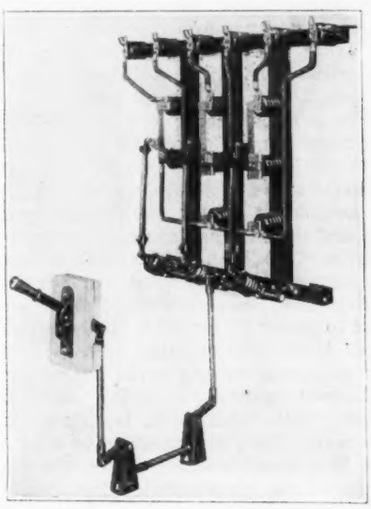
The electric lead-burning set recently placed on the market by the Spence Electric Company, 136 Liberty Street, New York City, was developed for particular use in garage and battery repair stations for burning the straps and posts on storage batteries and for other lead-burning work.

It can be connected to a 110-volt alternating-current lighting circuit through a socket and is operated in a manner similar to that of an electric soldering iron. Any degree of heat may be obtained, it is said, and perfect control is afforded by varying the pressure at the point of contact. An advantage of this electric set is that skill in operation is not required as when gas-flame outfits are used, and in addition there are no gas fumes to contend with. The energy consumption of the set is approximately equal to that of a 300-watt lamp. The outfit is portable, weighing 30 lb. (13.6 kg.) and having dimensions of 8 in. (20 cm.) by 7 in. (18 cm.).

## Switching Arrangement for Electric Furnaces

To obtain two voltages on the secondary side of electric furnace transformers, the switching combination illustrated has been designed by the Delta-Star Electric Company, 2433 Fulton Street, Chicago. The variation in secondary voltage is secured by changing the high-tension side of the transformers from delta to star in order to secure the lower secondary voltage and from star to delta when a high voltage is desired.

The switch for making these changes



INSURES VARIATION IN SECONDARY VOLTAGE OF FURNACE

consists of two single-pole double-throw elements and one single-pole single-throw element, all interlocked and simultaneously operated by means of a common shaft and controlled by a handle mounted on the switchboard. This handle is adjacent to the oil-switch handle, the two being interlocked so that the disconnecting switches cannot open until the oil switch is in open position, and the latter cannot close until the disconnecting switch is secured in either up or down position.

## Fixture of Doric Design for Commerical Illumination

Designed to utilize the efficiency of the smaller sizes of type C gas-filled lamps a lighting fixture, known as "Lightolier" No. 8544, is now manufactured by the Lightolier Company, 569 Broadway, New York City. It is intended for commercial illumination and has a Doric design canopy and fitter, together with a translucent glass globe. The over-all length of the fixture is 36 in. (91 cm.), the depth of the bowl is 8 in. (20 cm.), and its diameter is 11½ in. (28 cm.). Gas-filled lamps up to and including 200 watts may be used.

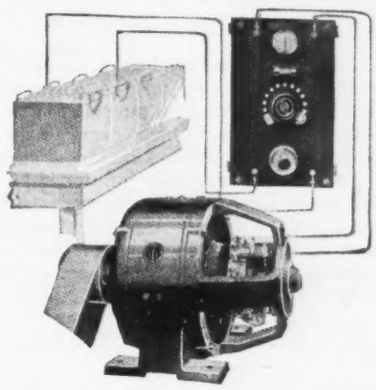
ADAPTED FOR LAMPS OF 200 WATTS OR LESS

## Receding Pipe Threader with Quickly Releasing Chasers

Two special advantages are claimed for the receding pipe threader recently added to the line of tools made by the Greenfield Tap & Die Corporation, Greenfield, Mass. One is the quick releasing of the chasers at the end of the cut and the other is the quick resetting to cutting size. After the tool has been wound on the pipe and a thread of proper size cut, the threader may be pulled straight off. No unwinding is necessary to return the thread to its original cutting position, as it is only necessary to release the lead screw, lift the head, reset the trigger and begin another cut. The chasers used in this tool are interchangeable and can be replaced singly in case of breakage. These chasers travel along the pipe parallel to the thread they are cutting and not parallel to the pipe's axis, in this way reducing considerable friction, it is said. A non-slipping, three-jawed universal chuck guide is provided on the tool. Adjustment can be made for cutting both shallow and deep threads.

## Lighting and Battery-Charging Outfit

With the lighting and battery-charging set recently developed by the Hobart Brothers Company of Troy, Ohio,



CHARGES BATTERIES AND LIGHTS LAMPS AT SAME TIME

a garage not having energy available from other sources can make its own electric light and at the same time have power on hand to recharge automobile storage batteries. The generator used in this set is a specially wound machine rated at 110 volts, direct current, and a speed of 1800 r.p.m. It weighs 300 lb. (136 kg.) and operates from a line shaft or an engine, requiring 4 hp. at full load. The maker states that from one to six 6-volt automobile storage batteries or their equivalent can be charged at one time.

This set is furnished complete, ready to connect to the engine, and includes the generator, base tracks, field rheostat, charging panel and a pulley with a 6-in. (15-cm.) diameter and a 4-in. (10-cm.) face. Outfits can also be furnished with 60-75-volt windings for industrial tractor recharging and with 60-volt windings where 60-volt lamps are to be used.

## Arc Protective Equipment for Drum Controllers

By adding the arc master equipment which the Union Electric Manufacturing Company, Milwaukee, Wis., is manufacturing to reversing or non-reversing weatherproof-type drum controllers it is said that the following advantages are obtained: The human element of carelessness or inexperience in operation is nullified, the controller is made arcless, all arcing circuits are broken on contacts, low-voltage protection is provided, and, if desired, overload protection can be secured.

The equipment consists of the arc master, mounted on the head of the

controller and operated by the motion of the standard controller handle and a solenoid switch. Three wires for a pilot circuit run from the arc master to the solenoid switch. This switch is a magnetic blow-out type designed for continuous duty and is mounted on a slate panel which can be conveniently attached in any position.

With the arc master equipment the operator can advance the motor speed only as the motor is capable of picking up the load. If he accelerates too rapidly, he loses his circuit and must commence all over. He cannot draw long-burning arcs and he cannot reverse too rapidly.

All circuits breaking heavy currents have the arc broken on the solenoid switch designed for this purpose. The resistance circuits, which carry very little current, are broken in the drum. These arcs are practically infinitesimal, owing to the blow-out coils incorporated in the standard drum. A slight reverse motion of the controller handle causes the circuit to be opened by the solenoid switch, thus eliminating the possibility of an arc being established when the controller is moved to the "off" position.

## Glareless Industrial Lighting Fixture

For giving even and well-diffused illumination without glare in factories and other industrial plants "Factorylite" No. 700 has been developed by the Henkel & Best Company, Chicago, and is being distributed by the Federal Sign System (Electric), Lake and Desplaines Streets, Chicago. This fixture is intended for use with lamps of 100 watts and 200 watts and gives best results when installed with spacings not more than one and a quarter times the mounting height above the lighted plane. A feature of this fixture is the opal-glass eye shield which fits around the bottom of the bulb, it being suspended by a holder. The metal reflector is furnished with a fitter for a ½-in. (1.3-cm.) stem and with a porcelain socket. A condulet on the stem supports a pull-chain switch.

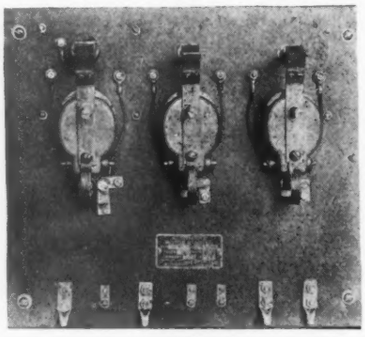
BALL SWITCH IS MOUNTED ON STEM OF FIXTURE

## Quick-Break Entrance Switch

Combination switch No. 5741 for two-pole, 30-amp., 125-volt service has been announced by the Trumbull Electric Manufacturing Company, Plainville, Conn. This switch is practically the same as style No. 5641, using fuse plugs, but does not have the safety interlocking features of that model. It is externally operated and meets most requirements for entrance work where a switch is rarely opened. Quick-break switch mechanism is used and is contained in a sixteen-gage steel box. The handle rod extends across the interior of the box and is held firmly to the side. When the box is opened the overlap rests on the top of the box so that the cover stays open, thus making for convenience in replacing fuse plugs and other work on the switch mechanism. Provision is made for locking the cover with either one or two padlocks.

## Current-Limiting Counter-Emf. Starter

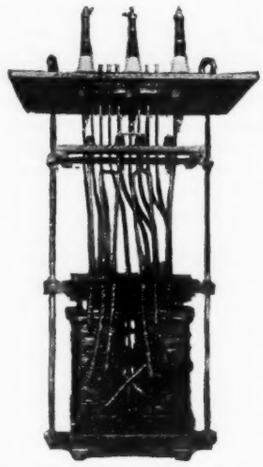
For use on board ship the type "O" current-limiting counter-emf. starter for direct current has been developed by the Automatic Switch Company, 4 White Street, New York City. It comprises a magnet line contactor and two resistance-bridging magnets, specially finished in copper throughout, with waterproof resistance, copper-plated frame, etc., the coils being impregnated to prevent injury from moisture. In this type of control the magnets are said to be unaffected by the widely varying angle of mounting used on board ship.



FOR DIRECT-CURRENT SERVICE ON BOARD SHIP

## Core-Type Transformers for Furnace Control

The electric furnace owes its growing acceptance as a desirable medium both for heat-treating steel and melting non-ferrous metals chiefly to the exacting control it offers over temperature conditions. As a link in the control equipment of its Baily electric furnaces, the Electric Furnace Company, Alliance, Ohio, is building special transformers of the core type with a 400-kva. rating. The high-tension side of these transformers is fitted with the customary voltage taps and wound for 22,000 volts, and the low-tension side has ten special voltage taps to meet the particular voltage requirements of the furnace. Each transformer is single-phase, and for small furnaces, requiring 100 kw. or less, one transformer is said to be sufficient. Three-phase current is taken care of by two transformers fitted with a Scott connection. By means of the special low-tension voltage taps any desired current input may be delivered to the furnace through the selective oil-break switches that are a part of each installation. With furnace current under control, any furnace temperatures may be steadily maintained.



ANY DESIRED CURRENT CAN BE DELIVERED TO FURNACE

## Engineless Farm-Lighting Plants

Storage batteries, a generator and switchboard compose the farm-lighting plant manufactured by the Superior Engineering Company, Jenkins Arcade, Pittsburgh, Pa. No driving unit is furnished because the company wishes to avoid duplication on farms which are already equipped with some means of generating mechanical power.

The generator of this set is designed for rough service and has a commutator with small segments to insure a smooth, flickerless light. A sliding base makes it possible to take up belt slack readily, and the bearings are said to require infrequent oiling. Standard pulleys are customarily furnished, but flywheel pulleys can be obtained which are said to assist in giving a steadier light when the current is used directly from the generator to any great extent.

Sixteen sealed glass-jar storage-battery cells with thick, lasting plates are used. They are mounted on a rack, and it is possible easily to see the condition of the plates, watch the level of the electrolyte and determine whether each cell is receiving a charge. The switchboards are furnished with a voltmeter and a double-reading ammeter which shows both charge and discharge. There is a rheostat for controlling the rate of charge, an automatic circuit

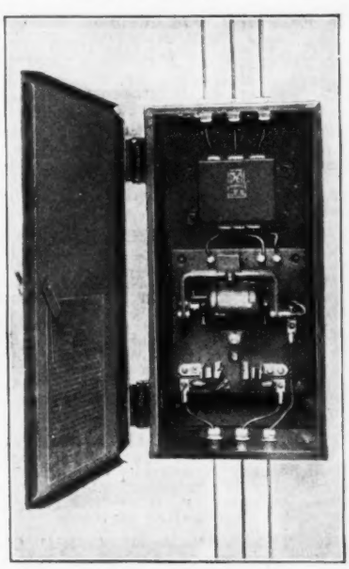
breaker and the necessary switches and cartridge fuses. These sets are supplied in sizes from the twenty-five, forty and fifty-light plants with 32-volt batteries up to 10-kw. and 24-kw., 110-volt plants.

## Ratchet Receding Pipe Threader for Limited Space

To perform pipe-threading operations in places where space is limited a ratchet receding pipe threader has been developed by the Greenfield Tap & Die Corporation of Greenfield, Mass. The ratchet mechanism of this device represents the only change from the receding pipe threader made by this company and is incorporated directly in the die stock instead of being made an attachment. The head is so designed that the pulling strain of the handles comes directly back of and in line with the chasers, thus minimizing the pull and preventing danger of trouble caused by twisting strains. The threader is made with two-handle lugs, two handles being furnished with the tool. When it is to be used with the ratchet mechanism one of these handles is taken off and the tool will then swing in a 14-in. (35-cm.) circle; but it is equally feasible to disengage the ratchet, screw the second handle into place in its lug, and use this tool just as the regular receding pipe threader is operated.

## Reverse-Phase Protective Relay

For installation where a reversal of phase may result in a serious accident. Schweitzer & Conrad, Inc., 4431 Ravenswood Avenue, Chicago, are now manufacturing a device known as a reverse-phase protective relay. It includes an arrangement for operating two stationary contacts and a moving contact which bridges the two stationary ones when it falls into position. The moving contact is held in the normal position by cams mounted on the end of the shaft of the operating mechanism. The entire relay is mounted in an approved sheet-iron box.



AN ARRANGEMENT OF TWO STATIONARY AND ONE MOVING CONTACT

The operating element is connected through a small transformer to the terminals of the motor being protected, and the three short-circuiting contacts are connected to the load side of the fuses protecting the motor. The operating element connections are made so that as long as the motor rotates in the proper direction the retaining cam holds the moving contact in the normal or open position. If a reversal of the supply wires occurs, the operating element rotates the retaining cam approximately 90 deg. and releases the moving contact. Since these three contacts are directly connected to the load side of the fuses protecting the motor, these fuses will be blown. This disconnects the motor and prevents its further use until the trouble has been investigated and corrected. This reverse-phase relay can be furnished in 100-amp. and 200-amp. sizes, the smaller size being suitable for any motor that requires fuses up to 100-amp. and the larger size for motors requiring between 100-amp. and 200-amp. fuses.

## *Notes on Recent Appliances*

### Show-Window Lighting System

"Ready-to-install" lighting systems for show windows are being made by Frederick A. Watkins, 565 West Washington Street, Chicago.

### Semi-Indirect Lighting Fixture

The Wheeler Reflector Company, 156 Pearl Street, Boston, Mass., has made several improvements in its "Mellowlight" semi-indirect lighting fixture.

### Induction Motor Rotors with Cast Windings

Cast squirrel-cage windings are now used for the rotors of induction motors made by the General Electric Company of Schenectady, N. Y.

### Ammeters and Voltmeters

Two types of ammeters and voltmeters have been placed on the market by the Dongan Electric Manufacturing Company, 745 Franklin Street, Detroit, Mich.

### Pendent or Ceiling-type Fixtuer

The "Reth-Lite," a commercial lighting fixture of the pendent or ceiling type, is being manufactured by the Retherford Brothers Company, Muncie, Ind.

### Continuous Recuperative Annealing

For the annealing of alloy steel bars and wires the Electric Furnace Company, Alliance, Ohio, has produced a continuous recuperative annealing furnace.

### Automatic Light and Power Plant

Self-contained electric lighting and power plants for farms and isolated dwellings are now marketed by R. M. Owens & Company, 722 South Michigan Avenue, Chicago, Ill.

### Welding Apparatus for Alternating Current

The Arcwell Corporation, 42 Broadway, New York, has just placed on the market an electric welding machine built for operation on alternating current of any specified voltage or frequency.

### Attachment Plug

One piece, fuseless attachment plugs are being sold by the Stuart Products Corporation, 440 South Green Street, Chicago, Ill.

### Domestic Flatiron

Electric flatirons with two points for domestic use are now manufactured by the Central Flatiron Manufacturing Company, Johnson City, N. Y.

### Electrical Tool, Cutter and Surface Grinders

The Saphil Manufacturing Company, 147 West Austin Avenue, Chicago, has developed a portable electrically driven tool, cutter and surface grinder.

### Dome-Reflector Sockets

Standard dome-reflector sockets, known as "RLM," are being made by the Benjamin Electric Manufacturing Company, 120 South Sangamon Street, Chicago.

### Automatic Egg Boiler

Automatic electric egg boilers for 110-volt circuits have been developed by the Duparquet, Huot & Moneuse Company, 108 West Twenty-second Street, New York City.

### Prophylactic Cabinet

To operate pressure sprays for treating the teeth a prophylactic cabinet containing an inclosed motor-driven air compressor is being marketed by Reid & Pancoast, 313 Vine Street, Philadelphia.

### Knife Switch

Renewable fuses are a part of the knife blades in the "Navy" type switch being marketed by the Metropolitan Electric Manufacturing Company, Fourteenth Street and East Avenue, Long Island City, N. Y.

### Copper Nuts

The Mutual Electric & Machine Company, Detroit, Mich., is now manufacturing copper nuts by a new copper-flowing process which eliminates machining on the outside of the nut. The threads are, of course, drilled and tapped.

## Trade Notes

### Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A commercial agent in France (No. 29,120) desires to secure an agency for the sale of electrical goods. Correspondence may be in English.

A man in Switzerland (No. 29,115) desires to secure an agency for the sale of electrical apparatus such as dynamos or electric locomotives. Correspondence may be in English.

A company in Spain (No. 29,126) desires to purchase and secure an agency for the sale of electrical goods. Cash will be paid as per arrangements. Correspondence should be in Spanish.

A machinery dealer in France (No. 29,134) desires to purchase electrical apparatus. Correspondence should be in French. Descriptive literature and quotations are solicited.

An American firm (No. 29,124) which has recently been appointed as representative of a company in New Zealand desires to secure agencies for the sale of electrical goods. Quotations should be given f.o.b. New York or San Francisco. Payment will be by established letter of credit or sight draft.

A company in Australia (No. 29,158) desires to receive catalogs of machinery for the manufacture and distribution of compressed air, fans and blowers for both air and gas, insulating materials for electricity and heat, electric furnaces, factory lighting, boilers, centrifugal and reciprocating pumps, fire tiles and firebricks.

A firm in this country (No. 29,153) with a branch in Italy, and also proposing to open offices in other European countries, desires to secure agencies for the sale of electrical railway equipment, metal goods and other electrical supplies, and especially insulated wires, cables, rubber goods and all the machinery and materials for their manufacture.

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COYNE SCHOOLS DESIRE CATALOGS AND SAMPLES.—Manufacturers' and jobbers' catalogs of electrical goods, as well as samples of all kinds, are desired by the electrical department of the Coyne Trade and Engineering Schools, Chicago.

FEDERAL TRADE COMMISSION ACTIONS.—Formal complaint has been filed against the Universal Battery Service Company, Chicago, alleging false and misleading advertising. Complaint against the Victor Electric Corporation, Chicago, has been dismissed.

BALL-BEARING MANUFACTURERS COMBINE.—The S K F Administrative Company, 5 Nassau Street, New York City, just announces a reorganization, effective May 1, whereby the products of the Hess-Bright Manufacturing Company, the S K F Ball Bearing Company, the Atlas Ball Company and the Hubbard Machine Company will be sold through one central organization. The new company—S K F Industries, Inc.—will be under the direction of B. G. Prytz, president, W. L. Batt, vice-president, J. P. Walsh, comptroller, and S. B. Taylor, sales manager. The principal office will be at 165 Broadway, New York City, with branches at Boston, Philadelphia, Atlanta, Buffalo, Cleveland, Detroit, Cincinnati, Chicago and San Francisco.

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THE HUTCHINSON STORAGE BATTERY COMPANY, Trenton, N. J., manufacturer of storage batteries, has completed plans for the construction of a new one-story addition to its plant on South Warren Street, to cost $15,000.

F. C. MYERS, formerly with the Society for Electrical Development, and more recently with the W. R. C. Smith Publishing Company, has been appointed district manager of the Baker R. & L. Company, manufacturer of electric vehicles, for the South.

C. J. HOLSLAG sailed for England on March 28 for a stay of several months, during which time he will assist in forming an English factory branch of the Electric Arc Cutting & Welding Company, Newark, N. J., manufacturer of portable cutting and welding devices.

THE WIRELESS SPECIALTY APPARATUS COMPANY, Albany, N. Y., has increased its capital to $700,000.

W. H. GREEN has been appointed Pacific Coast manager of the Chicago Fuse Manufacturing Company, with headquarters in San Francisco.

H. M. NEWKIRK, formerly mechanical engineer of the Hygrade Lamp Company, Salem, Mass., has resigned to enter private business in Boston.

THE STAR ELECTRODE WORKS, Niagara Falls, N. Y., have commenced the erection of a new one-story plant addition, about 25 ft. by 70 ft., for increased output.

THE ELECTRO STEAM RADIATOR COMPANY has moved its offices to 22 West Monroe Street, Chicago, and has moved its factory to 147th and State Streets, Harvey, Ill.

THE WIRELESS SPECIALTY APPARATUS COMPANY, Albany, N. Y., manufacturer of wireless apparatus and special equipment, has filed notice of an increase in capital to $700,000, for expansion.

CHAS. F. AMES & COMPANY, LTD., 90 West Street, New York, has been appointed to act as the New York sales department of the Platt Iron Works, Dayton, Ohio, manufacturers of pumping and power plant equipment.

C. D. SMITH, formerly manager of the Great Falls Electric Supply Company, Great Falls, Mont., has organized the firm known as the Cascade Electric Supply Company, with offices at 504 Central Avenue, Great Falls, Mont.

THE O. K. BATTERY COMPANY, Gary, Ind., will soon begin building a large plant in that city, one wing of the plant to be erected at a time. A site has been secured. It is planned to have the O. K. batteries on the market shortly.

J. McDONALD SMITH, formerly chief engineer of the Triumph Electric & Ice Machine Company, Cincinnati, has left that company to represent the Australian interests of the Texas Oil Company with headquarters at Sydney, Australia.

THE J. & M. ELECTRIC COMPANY, Utica, N. Y., has filed notice with the Secretary of State of an increase in its capital from $60,000 to $100,000. It is understood that the increase will be used to provide for extensions and general expansion.

THE LIBERTY STORAGE BATTERY COMPANY, Chicago, will purchase the factory building formerly occupied by the plant of the Brazil Stamping & Manufacturing Company at Brazil, Ind. The manufacturing will be removed from Chicago to Brazil.

THE STATES ELECTRIC SERVICE COMPANY announces the opening of its business at 1011 Farnam Street, Omaha, Neb., to engage in the repair of electrical equipment and the installation of light and power plants. C. W. Parker is manager.

BITTMAN & BATTEE, INC., manufacturers' agents, 84 Second Street, San Francisco, have been appointed representatives of the Hazard Manufacturing Company of Wilkes-Barre, Pa., manufacturer of steel and wire rope, electric wires and cables, etc.

THE ADJUSTABLE FIXTURE COMPANY, Manufacturers' Home Building, Milwaukee, Wis., manufacturer of distribution material, is reported to have increased its capital stock from $25,000 to $50,000, preparatory to increasing its facilities and output.

THE STANDARD ENGINEERING COMPANY, Mount Carmel, Pa., has been formed by M. J. Flynn, Frank McLoughlin and J. R. Cunningham. The company will carry on a general engineering business, electrical, mechanical and civil, besides attending to construction, repairing, appraisals and valuations.

THE MOHAWK ELECTRICAL SUPPLY COMPANY, Syracuse, N. Y., established a home appliance department in Syracuse a year ago to sell at retail in that city only. In this first year the department sold $33,000 worth of washers, ironers and cleaners, and this year it expects to sell not less than $50,000 worth of these appliances. This statement is from A. M. Little, president, in the March number of *The Mohawk Trail*.

## Trade Publications

GRAPHIC INSTRUMENTS.—In a new booklet the Esterline Company, Indianapolis, Ind., tells about its latest-type graphic efficiency instruments.

ELECTRIC RADIATOR.—The Electro Steam Radiator Company, 125 South Wells Street, Chicago, has issued an envelope stuffer showing three styles of its electro steam radiators.

LAVA.—The American Lava Company, Chattanooga, Tenn., has prepared a booklet about lava for mechanical and electrical purposes. Illustrations are included showing many articles of this material.

DISHWASHING MACHINES. — Two models of the Crescent electrically driven glass and dish washer are described and illustrated in a leaflet from the Bromley-Merseles Manufacturing Company, 837 Larrabee Street, Chicago.

WASHING MACHINES. — The Voss Brothers Manufacturing Company, Davenport, Iowa, has issued a booklet in which it presents about twenty advertisements which washing-machine merchants can use in advertising to their local trade.

NIGHT LIGHT.—"Baby Light," a new porcelain night lamp equipped with a transformer for reducing current from an ordinary lighting circuit to 6 volts, is the subject of a leaflet from the St. Louis Brass Manufacturing Company, St. Louis, Mo.

INDUSTRIAL LIGHTING.—The Henkel-Best Company, 122 South Michigan Avenue, Chicago, has issued a booklet on "Industrial Lighting and Production." Heavy-duty reflectors, shade-holder reflectors and two types of "Fac rylites" are described.

LIGHTING FIXTURES.—R. Williamson & Company, Washington and Jefferson Streets, Chicago, have issued a thirty-two-page catalog illustrating lighting fixtures grouped in sets to assist in selecting the right fixtures for each room in both town and country homes. The catalog also contains a few pages on electrical supplies and domestic appliances.

## New Incorporations

THE CAMPTON (N. H.) ELECTRIC LIGHT COMPANY has been chartered with a capital stock of $2,000 by Moody G. Dole, Erastus Dole of Campton, and others.

THE STAMPING GROUND (KY.) ELECTRIC LIGHT & POWER COMPANY has been incorporated by W. D. Adams, J. W. Palmer, C. B. Roberts and others. The company is capitalized at $6,000.

THE CLERMONT SUBURBAN POWER & LIGHT COMPANY of Amelia, Ohio, has been chartered with a capital stock of $2,000 by Frank C. Williams, J. M. Cook, C. B. Kergan, G. W. Hartwell and L. V. K. Keister.

THE MUTUAL POWER & LIGHT COMPANY of Burlington N. C., has been incorporated with a capital stock of $125,000 by Eugene Holt, James N. Williamson, Jr., of Burlington, and Lynn B. Williamson of Graham.

THE MINNESOTA STORAGE BATTERY COMPANY, 191 West Sixth Street, St. Paul, Minn., has been incorporated with a capital stock of $50,000. Ferris Price is president. O. W. Hart vice-president, and W. E. Lean secretary and treasurer.

THE HI-GLO COMPANY of Wheeling, W. Va., has been incorporated by Carl O. Schmidt, Henry L. and Herman L. Arbenz. The company is capitalized at $50,000 and proposes to manufacture electric signs and other metal illuminating displays.

THE TRI-COUNTY ELECTRIC COMPANY of Pompton Lakes, N. J., has been incorporated by E. V. and Samuel W. McElroy and Henry G. Hershfield. The company is capitalized at $25,000 and proposes to construct and operate an electric light plant in Pompton Lakes.

THE MILLING & LIGHTING COMPANY of Brasher Falls, N. Y., has been incorporated by R. Hefferman, T. D. Rochford and M. A. Hallahan of Brasher Falls, N. Y. The company is capitalized at $60,000 and proposes to generate and distribute electricity for lamps, heaters and motors.

## New England States

NASHUA, N. H.—The Nashua Manufacturing Company is planning a hydroelectric development at Mine Falls to furnish energy to operate its cotton mills. The proposed plans include the erection of a large power station and raising the present dam 13 ft.

RUTLAND, VT.—The Rutland Railroad Company is reported to be considering the installation of a number of electrically operated tools at its local repair shop and car repair works.

CAMPELLO, MASS.—Contracts, it is reported, will soon be awarded by the A. E. Keith Company, for the construction of power plant, 64 ft. by 71 ft., to cost about $56,000. Jenks & Ballon, Grosvenor Building, Providence, R. I., are engineers.

HOLDEN, MASS.—At a recent town meeting extensions were authorized to the municipal electric lighting service involving an expenditure of over $4,000.

HOLYOKE, MASS.—The Board of Public Works has requested the Gas and Electric Department to extend the High Street lighting system south to Cabot Street.

HOLYOKE, MASS.—Some contracts have been awarded by the Cortz Manufacturing Company of Holyoke for an addition to a manufacturing building, and to power house, to cost about $60,000.

IPSWICH, MASS.—An extension of the municipal electric lighting system to Linebrook Parish and an appropriation of $6,000 to pay for same was authorized by the voters at a recent town meeting.

NORTH KINGSTON, R. I.—Permission has been granted to the Wickford (R I.) Light & Water Company to erect and maintain electric transmission lines on several highways in the town. The Town Council has been authorized to enter into a contract with the company for 170 street lamps for a period of one year.

## Middle Atlantic States

DUNKIRK, N. Y.—Arrangements are being made by the City Council for the installation of a new ornamental lighting system throughout the principal business thoroughfares of the city.

EAST ROCHESTER, N. Y.—The Rochester Railway & Light Company is planning to erect a distributing station at East Rochester to supply electricity in Eastern Monroe and adjoining territory.

HUDSON, N. Y.—Bids will be received by the city clerk, Hudson, until May 15, for lighting the streets and public buildings of the city of Hudson with electricity for a period of five years, beginning Sept. 1, 1919.

TARRYTOWN, N. Y.—Contract has been awarded by the Chevrolet Motor Company, 112 East Fifty-seventh Street, New York City, to the White Fireproof Construction Company, 286 Fifth Avenue, for the construction of its plant at Tarrytown, to cost about $500,000.

CAMDEN, N. J.—The Camden Motor Company is planning to erect a new plant, to be located on the White Horse Pike, Collinswood, which with equipment will cost more than $$500,000. D. M. Davis, Temple Building, Camden, is interested in the company.

EAST ORANGE, N. J.—Arrangements have been completed by the Water Department for alterations and improvements in the municipal pumping station located at Millburn. Roswell M. Roper, 436 Main Street, East Orange, is engineer.

WANAQUE, N. J.—Steps, it is reported, have been taken by local men to organize a company to erect an electric transmission line from Pompton Lakes to Wanaque to transmit electricity from the Pompton Lakes power plant to supply energy in Wanaque and surrounding country.

ERIE, PA.—Negotiations are under way between the city officials and the Erie County Electric Company for removing the overhead electric wires on State Street and placing them in underground conduits.

ERIE, PA.—Bids will be received by the board of education, Erie, until May 12 for general work, heating, plumbing, electric work, clocks, bells and telephones and vacuum-cleaning system for the new East Side High School building. Plans and specifications may be secured from R. S. Scobell, business manager, board of school directors, Erie. For details see Searchlight section.

McKEE'S HALF FALLS, PA.—Steps have been taken to organize a company to be known as the Susquehanna Power Company, to construct a hydroelectric power plant at McKee's Half Falls to supply electricity in this town, Port Trevorton, Selinsgrove and adjacent teritory. E. C. Williams, F. A. Bingaman, T. M. Vanzandt of Port Trevorton and George C. Wagenseller of Selinsgrove are interested in the project.

MEADVILLE, PA.—Plans have been prepared for the erection of a new pumping plant, to cost about $11,000, to be used for municipal service. F. Ellsworth is superintendent of waterworks.

PHILADELPHIA, PA.—Contract has been awarded by the Department of City Transit to the North American Railway Construction Company, Chicago, Ill., for construction of the proposed surface railway line to extend from Oxford Avenue, Frankford section, to the city farms at Byberry, a distance of 10 miles, of which it is planned to build 6 miles, as far as Bustleton, for initial operation.

PITTSBURGH, PA. — The West Penn Traction Company, it is reported, is contemplating the erection of machine repair shops at South Warwood, W. Va.

PITTSBURGH, PA.—A portion of the plant of the Electric Manufacturing & Repair Company, First Avenue, was recently damaged by fire. The company, it is understood, will rebuild at once.

NORFOLK, VA. — R. E. Sparks, St. George Hotel, Norfolk, is contemplating the installation of an electric welding machine, motor-generator and switchboard.

WASHINGTON, D. C.—The Potomac Electric Power Company has petitioned the Public Utilities Commission for permission to issue $1,750,000 in bonds to cover additions to its plant at Benning.

## North Central States

DETROIT, MICH.—Plans are being prepared by the Detroit Seamless Steel Tube Company, 841 West Jefferson Avenue, for the erection of a new factory on Wyoming and West Warren Avenues, to cost with equipment about $1,700,000. A. A. Templeton is president.

HIGHLAND PARK, MICH.—Bids will be received by the city of Highland Park at the office of the city clerk, 20 Gerald Avenue, until May 12 for general work, heating, plumbing, electric work, lighting fixtures, refrigeration, sterilizers, laundry machinery, cooking apparatus, etc., for a four-story basement and sub-basement hospital building, a two-story power house and laundry and connecting tunnel for the city of Highland. Separate bids will be received for each, all or any number of the above items. Plans and specifications may be obtained upon application to L. C. Whitsit, city engineer, 28 Gerald Avenue, Highland Park, for which a deposit of $25 will be required.

CLEVELAND, OHIO.—A six-story power block will be erected on East Eighteenth Street by the Paul Brothers Company, in which quarters will be provided for light manufacturing purposes.

CLEVELAND, OHIO.—Plans are under consideration by G. W. Hale, Leader-News Building, for the construction of a garage on East Ninth Street and Bolivar Road, to cost about $250,000..

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of the division of purchases and supplies, City Hall, Cleveland, until May 9 for auto trucks for the Division of Light and Heat. Specifications may be obtained upon application to Room 204, City Hall.

DAMASCUS, OHIO.—The establishment of a municipal electric light plant in Damascus is under consideration.

EATON, OHIO.—The Eaton Lighting Company is negotiating with the Greenville (Ohio) Electric Light & Power Company for energy to operate its local system.

LEBANON, OHIO.—Improvements to the municipal electric light plant, to cost about $14,000, are under consideration.

MANSFIELD, OHIO.—The Kenney Company is considering the installation of new electrical machinery and new equipment for machine shop. Jacob Cousins is treasurer.

DECATUR, IND. — The Public Service Commission has granted the Farmers' Light & Power Company and the Preble (Ind.) Light & Power Company permission to erect their electric transmission line to furnish electrical service east of the city and to the residents of Preble. Both companies will secure electricity from the Decatur Light & Power Company.

EVANSVILLE, IND.—The erection of a new engine house with shop facilities, to cost about $125,000, is under consideration by the Louisville & Nashville Railroad Company of Louisville, Ky.

FRANKLIN, IND.—The Hatfield Electric Company of Indianapolis has been awarded the contract for electrical fixtures for the new dormitory at the Masonic Home, to be erected at a cost of $42,500.

PERU, IND.—The American Gas & Electric Company, 30 Church Street, New York, N. Y., has submitted a proposal to the City Council to supply electricity for the local system from its plant in Marion. It is proposed to erect a high-tension transmission line from Marion to Peru and connect with the switchboard at the municipal plant. O. M. Drischell is general manager of the Marion Light & Heating Company.

ALVIN, ILL.—The Public Utilities Commission has granted the Rossville Electric Light Company permission to erect an electric transmission line from Alvin to Bismarck and to furnish electrical service in Bismarck, and also to residents along the line.

ELDORADO, ILL.—The installation of a municipal electric light plant in Eldorado is under consideration.

HILLSDALE, ILL. — The Public Utility Commission has granted the Rock River Valley Light & Power Company a franchise to erect an electric transmission line from Silvis to Hillsdale and also to install and operate distribution systems in Barstow, Joplin and Hillsdale. The company has also been given authority to issue $20,000 in capital stock.

LENA, ILL.—The Lena Electric Light & Power Company has taken over the property of the Warren Light & Power Company, including the service wires to Apple River. The erection of an electric transmission line from Lena to Warren is contemplated by the Lena company and also furnishing electrical service to intervening towns.

PLEASANT PLAINS, ILL.—The Abbott Light & Power Company has been granted permission to install and operate an electric distribution system in Pleasant Plains.

SPRINGFIELD, ILL. — The Board of Public Works has authorized the installation of a new lighting system in Reservoir Park.

WOODSTOCK, ILL.—The installation of a new engine in the municipal electric light plant is under consideration.

FOND DU LAC, WIS.—The City Commission has adopted an ordinance requiring all overhead wires placed in underground conduits in the downtown business district within sixty days.

MENASHA, WIS.—Bids will soon be awarded by the Peerless Paper Products Company for the erection of an addition to its mill and an extension to the boiler house and transformer station. The cost including equipment is estimated at about $75,000. L. A. DeGuere of Grand Rapids is consulting engineer.

MILWAUKEE, WIS.—Contracts aggregating $580,000 will be awarded this year in connection with the municipal electric lighting system. The work for installing the system will amount to $180,000, and the material to be used will cost approximately $400,000. The lowest bids for the work were submitted by the Cummings Company of Chicago, Ill., at $176,000, and the Dean Construction Company of Milwaukee, at $180,000. To date the city has appropriated $1,500,000 for the installation of the system.

STURGEON BAY, WIS.—The Universal Shipbuilding Company is planning to build an addition to its power plant, to cost about $30,000.

WAUPACA, WIS.—Preliminary plans, it is reported, have been prepared by E. Orbison, engineer, Appleton, for the construction of a hydroelectric power plant on Little Wolf River to develop about 150 hp. The cost is estimated at $200,000. F. H. Josslyn, Algoma Block, Oshkosh, is interested.

HASTINGS, MINN.—The Legislature has made an appropriation of $25,000 for a power plant for the Hastings State Hospital, the money to be available July 31, 1919; also $5,000 for power-plant repairs. An appropriation of $125,000 was also made for completion of power plant, the money to be available July 31, 1920.

## *Construction*

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

RED CLOUD, MINN.—The municipal electric light plant was recently damaged by fire.

DUBUQUE, IOWA.—A petition has been presented to the City Council requesting that an election be called to submit to the voters the proposal to establish a municipal electric light and power plant.

STORY CITY, IOWA.—The proposal to issue bonds for rebuilding the municipal electric light plant will be submitted to the voters. The cost is estimated at about $50,000.

TRAER, IOWA.—The town officials are considering establishing a municipal electric light plant and contemplate either purchasing the equipment of the local company or building a new plant.

ST. LOUIS, MO.—A report submitted to the Board of Public Service by Ralph Toensfeldt, engineer of the Department of Public Utilities, estimates the cost of installing municipal street lighting at $1,260,400. The plan provides for the use of the city's conduits, which are now used for carrying the wires of the police and municipal telephone wires.

FARGO, N. D.—Bonds to the amount of $150,000 have been voted for the installation of a municipal electric light plant.

HANKINSON, N. D. — The Richland Power & Light Company, recently incorporated with a capital stock of $50,000, proposes to erect an electric transmission line from Wahpeton to Moorston, where it will connect with the transmission system of the Otter Tail Power Company.

JAMESTOWN, N. D.—At an election held recently the proposal to issue bonds for the installation of a municipal electric light plant was carried.

GREGORY, S. D.—At an election held recently the proposal to issue bonds for the installation of a municipal electric light plant was carried.

VERMILION, S. D.—An election will be called to submit to the voters the proposal to issue $60,000 in bonds to construct a municipal electric light plant in Vermilion.

TRUMBULL, NEB.—At an election held recently $6,000 in electric light bonds were voted.

YORK, NEB.—Plans are being prepared by W. F. Gernandt, architect, Keeline Building, Omaha, for a power house, to cost about $12,000, and an addition to the Lutheran Hospital, to cost about $40,000.

NEODESHA, KAN.—Bids will be received by the city of Neodesha until May 7 for the installation of an ornamental lighting system. Specifications may be obtained from F. O. Williams, chairman.

PITTSBURG, KAN.—The State Legislature has made an appropriation of $10,000, to be available after July 1, for new equipment for the power plant at the State Normal School at Pittsburg, including the installation of a 125-hp. tubular boiler, etc. J. A. Kimball, State House, Topeka, is business manager.

ST. JOHN, KAN.—Bonds to the amount of $45,000 have been voted for improvements to the municipal electric light plant and waterworks system.

## Southern States

BRIDGEWATER, N. C.—The Southern Power Company of Charlotte, it is reported, has made arrangements with the Rinchart & Dennis Company of Charlottesville, Va., to take over and complete the Sydo hydroelectric development, including the construction of dams and power house. The cost is estimated at about $400,000.

HENDERSONVILLE, N. C. — The Blue Ridge Power Company is contemplating the construction of a hydroelectric power plant with steam-power equipment for emergencies. The cost of the project is estimated at about $1,000,000, which will include a dam with 300-ft. fall, railroad bridge and a 300-acre lake. John A. Law, of Spartanburg, S. C., is secretary.

SPARTANBURG, S. C.—The City Council has awarded the South Carolina Light, Power & Railways Company a contract for lighting the city for a period of ten years, beginning October, 1919. Under the terms of the new contract the company will install an ornamental lighting system in the business district.

LYONS, GA.—The Council is considering issuing bonds for improvements to the municipal electric light plant.

REIDSVILLE, GA.—The City Council has awarded a contract for the installation of an electric light plant in Reidsville to the J. B. McCrary Company of Atlanta, at $12,000.

BRADENTOWN, FLA.—Bids will be received by the city of Bradentown, until May 30 for complete electrical equipment for opening a bascule bridge. Plans and specifications may be obtained on application to the Scherzer Rolling Lift Bridge Company of Chicago, Ill. Harry Wadham is commissioner of public works.

TALLAHASSEE, FLA. — Preparations are being made by the city of Jacksonville to rebuild the municipal electric light and power plant, recently destroyed by fire. The loss is estimated at $75,000. The waterworks pumping station (electrically driven) was also put out of commission. Gasoline-driven engines will be installed at the waterworks.

COALFIELD, TENN. — The Coalfield Company, it is reported, is planning to rebuild its power plant, recently destroyed by fire. The cost is estimated at about $5,000.

FAIRFIELD, ALA.—A large section of the works of the Tennessee Coal, Iron & Railroad Company was recently destroyed by fire, including machine shop, forge and blacksmith shop, carpenter and woodworking shop, rigger shop and electric substation. The loss is estimated at about $65,000. The buildings, it is understood, will be rebuilt.

CLARKSDALE, MISS.—At an election to be held May 12 the proposal to issue $300,000 for improvements to the water and electric light systems, construction of sewers, paving, etc., will be submitted to the voters. The plans include the installation of turbine, boiler, feed pump, transformer, boiler, construction of reservoir, laying additional mains, etc.

GURDON, ARK.—M. B. Morgan, owner of the local electric light plant, is negotiating with the City Council of Prescott to secure electricity from the Prescott municipal electric plant. Mr. Morgan proposes to erect a high-tension transmission line from Gurdon to Prescott.

SPRINGDALE, ARK.—The installation of a municipal electric light plant is under consideration by the City Council. W. L. Winters, 700 South Twentieth Street, Fort Smith, is engineer.

DONALDSON, LA.—Plans are under consideration to extend the municipal electric light and power system beyond the corporate limits of the city, to include the whole of what is known as the Faubourg La Pipe. Joseph W. Byrnes is manager.

COMMERCE, OKLA. — Arrangements have been made for erecting street lamps in the business section on Commerce Street. Electric lamps will probably be erected on other business streets, although definite plans have not been made.

EL RENO, OKLA.—The W. E. Bible Storage Battery Manufacturing Company is planning to establish a plant for the manufacture of storage batteries. The cost of the equipment is estimated at about $50,000.

GROVE, OKLA.—Preparations are being made for improvements to the municipal electric light plant and waterworks system.

HANNA, OKLA.—Arrangements are being made by the Commercial Club for the installation of a new electric plant in Hanna.

TAHLEQUAH, OKLA.—The installation of an electric light and power plant is under consideration by the City Council. The cost is estimated at about $65,000.

TULSA, OKLA.—Plans are being considered for extensions to the street-lighting system on Fifteenth Street to Terrace Drive. Additional lamps will also be erected in West Tulsa.

ABILENE, TEX.—The electric light and power and waterworks plants of the American Public Service Corporation at Abilene, recently destroyed by fire, will be rebuilt as soon as machinery and material can be obtained. The new plants will cost about $300,000.

CLIFTON, TEX.—The Waco Mill & Elevator Company of Clifton is planning to erect a grain elevator of 75,000 bushels capacity, to be equipped with electrically driven machinery.

FORT WORTH, TEX.—Work will soon begin on the survey of the proposed electric railway to run between Fort Worth and Mineral City. Right-of-way for the first 45 miles out of Fort Worth has been secured. Richard Feris and H. E. Robison of Fort Worth are promoters.

FORT WORTH, TEX.—The Alexander Lumber Company has awarded contract to Miller Brothers of Fort Worth for all electrical work in connection with its proposed new plant. The company proposes to manufacture portable buildings for use principally in oil fields and for export trade.

STEPHENVILLE, TEX.—The installation of an electric light plant at the John Tarlton Agricultural and Mechanical College, to cost about $40,000, is under consideration.

WACO, TEX.—J. F. Strickland, president of the Texas Power & Light Company, has advised the City Commission of Waco that the company will build an addition to its plant, to cost $200,000, in Waco, provided the city will grant the company a new franchise to run until 1939. No action has been taken on the proposition.

## Pacific and Mountain States

SEATTLE, WASH.—The City Council has passed an ordinance authorizing the purchase of a 100-kw. motor-generator set for the lighting department.

SEATTLE, WASH. — An estimate has been submitted to the City Council by Thomas F. Murphine, superintendent of the public utilities, having control of street-car operations and betterments, of the cost of extensions, improvements and construction work contemplated for the municipal street-railway system, the total of which is $536,300.

FLORENCE, ORE.—The City Council is negotiating with G. G. Bushman, owner of the local electric light plant, for the purchase of the system, consisting of a steam electric generating station, street-lighting and distributing system for private consumers in Florence and in Grenada.

HOLLISTER, CAL.—The Board of Supervisors has granted the Coast Counties Gas & Electric Company of Santa Cruz a franchise to erect and operate electric transmission lines on the county roads and public highways.

MARE ISLAND, CAL.—Improvements have been authorized by the Bureau of Yards and Docks, Navy Department, Washington, D. C., to the Mare Island Navy Yard including slips and piers, doubling the capacity of power plant, new buildings, oil tanks and railway through Vallejo causeway to connect with the Southern Pacific Railway. The cost is estimated at about $2,500,000.

MONTEREY, CAL. — The Del Monte Light & Power Company, recently incorporated, has petitioned the State Railroad Commission for permission to issue $25,000 in capital stock for the purpose of purchasing from the Pacific Improvement Company its electric transmission system in Monterey County. The line has been appraised at $26,967. The Del Monte company proposes to purchase energy from the Coast Valleys Gas & Electric Company. H. Tiedmann is president of the Del Monte company.

SALMON, IDAHO.—The Harmony Mines Company is planning to erect an electric transmission line to connect with the Salmon River power plant. E. F. Nieman is general superintendent of the company.

MILLVILLE, UTAH.—Bonds have been authorized by the voters for the erection of an electric transmission line to secure electricity for lighting the town.

## Canada

VICTORIA, B. C.—The British Columbia Electric Railway is planning to lay a submarine cable across Victoria Harbor to supply electricity for industrial purposes on the Songhees Indian Reserve.

WINNIPEG, MAN.—Tenders will be received by the chairman of committee on fire, water, light and power, at the office of the city clerk, Winnipeg, until May 5 for a quantity of medium hard-drawn stranded copper cable, soft-drawn copper tie wire and copper jointing sleeves. Bids will also be received at the same time and place for 3000 more or less high-voltage porcelain insulators. Specifications, etc., may be obtained at the office of the City Light and Power Department, 54 King Street. C. J. Brown is city clerk.

MILLTOWN, N. B.—The Canadian Cottons, Ltd., has petitioned the International Joint Commission for permission to divert the St. Croix River and erect a power house on the river opposite Milltown, N. B. Improvements and additions are contemplated by the company involving an expenditure which is estimated at more than $500,000.

CLARKE HARBOR, N. S.—The Town Council is considering the installation of an electric lighting plant.

GALLETTA, ONT.—The Galletta Electric Power Company is considering the erection of an electric transmission line to Arnprior. E. R. Lock is engineer of the company.

PETERBOROUGH, ONT.—The construction of an electric railway from the junction of the Irondale & Bancroft Railway with the Grand Trunk Railway, running from Lindsay to Haliburton and extending this line through the townships of Galway, Harvey and Smith, to the old Cobourg & Chemong Railway at Chemong Lake, is under consideration by the Ontario Hydro-Electric Power Commission.

ST. CATHARINES, ONT.—Formal request to the Dominion government has been made by the Ontario Hydro-Electric Power Commission for an order in council authorizing immediate beginning of construction work on two hydro radials, one from Toronto to Bridgeburg, the other from Toronto to London. The two roads will have a total mileage of 250 miles and will cost about $26,000,000.

ST. RAPHAEL EAST, QUE.—Plans are being prepared by Gauvin & Lessard, civil engineers, 147 Côté de la Montagne, Que., for a 2000-hp. water development at St. Raphael on Rivière du Sud for La Compagnie Electrique de Montmagny. Bids, it is understood, will be asked in June for water turbines, generators and penstocks.

# *Directory of Electrical Associations*

Printed in the First Issue of Each Month

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, C. E. Drayer, 29 South La Salle St., Chicago, Ill.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West Fortieth St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. University of Pennsylvania, Philadelphia, Pa.

ARKANSAS UTILITIES ASSOCIATION. Secretary, W. J. Tharp, Little Rock, Ark. Annual meeting, Fort Smith, Ark., May 20-22.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York City.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, H. T. Edgar, Stone & Webster, Boston, Mass.

ASSOCIATION OF MUNICIPAL ELECTRICAL ENGINEERS OF ONTARIO. Secretary R. A. Clement, 190 University Ave., Toronto, Ont., Can. Annual convention, Niagara Falls, Ont., June.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & North Western Railway, Chicago, Ill.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, Capt. W. J. Conway, 406 Yorkshire Building, Vancouver, B. C.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, W. Volkman, Toronto Power Company, 12 Adelaide St. East, Toronto, Ont.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

CONFERENCE CLUB. Secretary, Sullivan W. Jones, 110 West 40th St., New York City. Annual meeting, White Sulphur Springs, May 1-3.

COMMERCIAL SECTION, N. E. L. A. Secretary, Henry Harris, Pittsburgh, Pa.

EASTERN NEW YORK SECTION, N. E. L. A. Assistant secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, Shiras Morris, Hart & Hegeman, Hartford, Conn.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Annual meeting, Hot Springs, Va., June 11-12.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, ATLANTIC DIVISION. Secretary, George E. Donald Tolles, 52 Broadway, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, PACIFIC COAST DIVISION. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRIC POWER CLUB, Secretary, C. H. Roth, 1410 West Adams St., Chicago, Ill.

ELECTRIC VEHICLE SECTION OF THE N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York City.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York City.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary-treasurer, R. V. Prather, Springfield, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donohue, Lafayette, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary, Alfred N. Goldsmith, College City of New York, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex. Annual meeting, Chicago.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA SECTION, N. E. L. A. Secretary-treasurer, M. G. Linn, Des Moines, Iowa.

JOVIAN ORDER. Jupiter (president), J. F. Strickland, Dallas, Tex.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, Detroit Edison Co., Detroit, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary and treasurer, Meyer Barnest, St. Paul, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Affiliated with the N. E. L. A. Secretary-treasurer, L. D. Gordon, Jackson Light & Traction Co., Jackson, Miss.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, 721 Locust St., St. Louis, Mo. Annual meeting, June 5-7, Excelsior Springs, Mo.

NATIONAL ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, W. H. Morton, 110 West 40th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee and Wisconsin. Annual meeting, Milwaukee, Wis., July 16-18.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Northeastern College, Boston, Mass. Annual meeting, Springfield, Mass., Oct. 13 and 14.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York City. Annual convention, Atlantic City, N. J., May 19.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, R. W. McGinnis, O'Neil Light & Creamery Co., O'Neil, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass. Annual meeting, Boston, Mass., June.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, Franz Neilson, 120 Broadway, New York City.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York City.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION. Affiliated with N. E. L. A. Secretary, George L. Myers, Pacific Power & Light Co., Portland, Ore.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual meeting, Cedar Point, Ohio, July 15-17.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OKLAHOMA UTILITIES ASSOCIATION. Secretary, H. A. Lane, 611 State National Bank Building, Oklahoma City.

PACIFIC COAST SECTION, N. E. L. A. Secretary, A. H. Halloran, 618 Mission St., San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION. State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston, W. Va.

RADIO CLUB OF AMERICA. Secretary, T. J. Styles, 152 Beach St., Yonkers, N. Y.

ROCKY MOUNTAIN ASSOCIATION OF MUNICIPAL ELECTRICIANS. President, Lawrence Stone, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York City.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOUTH DAKOTA ELECTRICAL POWER ASSOCIATION. Secretary-treasurer, O. J. Gronsdahl, Hartford, S. D.

SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, T. W. Peters, Columbus, Ga.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex. Annual meeting, Galveston, Tex., May 12-14.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Barglebaugh, 703 First National Bank Building, El Paso, Tex.

TORONTO ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. F. W. Salisbury, 615 Yonge St., Toronto, Ont.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C. Annual meeting, Greenwood, S. C., June 17-19.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Rutland, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. S. Netnercut, 1735 Monadnock Block, Chicago, Ill.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, J. P. Pulliam, 1408 First National Bank Building, Milwaukee, Wis.

(Issued April 1, 1919)

1,299,336. ELECTRIC FURNACE APPARATUS FOR ORES OR MINERALS; Ingenuin Hechenbleikner, Charlotte, N. C. App. filed Dec. 29, 1917.

1,299,337. METHOD OF TREATING GASES; Ingenuin Hechenbleikner, Charlotte, N. C. App. filed Dec. 29, 1917. Useful in preparing fertilizing material.

1,299,356. APPARATUS FOR USE IN RADIO-COMMUNICATION; Lee De Forest, New York, N. Y. App. filed Dec. 11, 1916. Electrodes of audion detector are not inclosed in evacuated vessel.

1,299,361. DIRECTION SIGNAL; Hyman Lieberman, Marinette, Wis. App. filed May 29, 1918. For automobiles.

1,299,376. AUTOMATIC STOVE LIGHTER; William J. Mulvaney, Lisle, Ill. App. filed Oct. 20, 1917. Electric circuit combined with thermostat automatically completes circuit and relights wick.

1,299,387. FUSE DEVICE; Edmund O. Schweitzer and Nicholas J. Conrad, Chicago, Ill. App. filed Dec. 31, 1914. For high potentials.

(Issued April 8, 1919)

14,631 (reissue). SWITCHBOARD; Hubert F. Krantz, Brooklyn, N. Y. App. filed Feb. 22, 1916. Immediate contact between switch plates and busbars.

1,299,414. ELECTROLYTIC REFINING OF METALLIC ZINC-BEARING MATERIALS; Charles H. Aldrich and John K. Bryan, Baltimore, Md. App. filed July 26, 1916.

1,299,427. RECORDING INSTRUMENT; Charles F. Chapman, Philadelphia, Pa. App. filed Aug. 29, 1916. Effective needle-deflecting means.

1,299,457. CONTACTOR; David E. Gray, Chicago, Ill. App. filed Feb. 12, 1917. Engages stationary contact, sticking being avoided.

1,299,485. PROCESS FOR MAKING HYDROGEN PEROXIDE; David Levin, Buffalo, N. Y. App. filed Feb. 3, 1916.

1,299,509. MECHANISM FOR CONTROLLING MOVEMENT; Jean A. Rey, Paris, France. App. filed Nov. 30, 1914. Of guns on board ship.

1,299,519. METHOD OF HANDLING ANODES IN ELECTROLYTIC BATHS; Heber M. Stuart, Baltimore, Md. App. filed July 26, 1916.

1,299,526. DAMPER-OPERATING MOTOR; Everett H. White, St. Paul, Minn. App. filed Jan. 10, 1916. Stops shaft when it arrives at predetermined position.

1,299,558. CALL-DISTRIBUTING SYSTEM; Gerald Deakin and Lipa Polinkowsky, London, Eng. App. filed March 24, 1917.

1,299,565. PROCESS OF ELECTRICALLY PREPARING CATALYSTS FOR HYDROGENATION; Carleton Ellis, Montclair, N. J. App. filed Nov. 14, 1916.

1,299,590. METHOD OF AND MEANS FOR SEPARATING WATER FROM HEAVY-OIL EMULSIONS; Charles W. McKibben, Houston, Tex. App. filed Oct. 24, 1918.

1,299,592. METHOD AND APPARATUS FOR IGNITING THE CHARGE IN INTERNAL-COMBUSTION ENGINES; Charles T. Mason, Sumter, S. C. App. filed Nov. 9, 1917.

1,299,602. SERVICE SWITCH; Granville E. Palmer, Brookline, Mass. App. filed April 23, 1913. Fuses are accessible upon the opening doors of safety switch.

1,299,606. CALL-DISTRIBUTING SYSTEM; Lipa Polinkowsky, London, Eng. App. filed March 24, 1917. Calls are automatically extended.

1,299,608. SELECTIVE SIGNALING APPARATUS; Louis M. Potts, Baltimore, Md. App. filed Oct. 11, 1913. Employs single transmitting contact.

1,299,617. ELECTRIC SWITCH; William H. Ripley, Orange, N. J. App. filed April 9, 1917. Quick opening action prevents arcing.

1,299,624. APPARATUS FOR ELECTROPLATING; Harry O. Schuessler, Peru, Ill. App. filed Jan. 28, 1918.

1,299,632. METERING SYSTEM; Ralph B. Stitzer and Harry E. Sovereign, Brooklyn, N. Y. App. filed May 7, 1914. Enables the reading of consumers' and station meter at same time.

1,299,646. COMBINED TYPEWRITING AND COMPUTING MACHINE; Alfred J. Wood, Brooklyn, N. Y. App. filed May 27, 1916.

1,299,649. HUMIDIFYING DEVICE FOR OVENS; Daniel H. Young and William L. Cass, Manchester, Iowa. App. filed June 13, 1918.

1,299,664. ELECTRIC FURNACE AND TRANSFORMER FOR USE THEREWITH; Frederick E. Berry, Hayes, Eng. App. filed Jan. 19, 1918. Distributes heat in three-phase furnaces.

## *Record of Electrical Patents*

Notes on United States Patents

1,299,693. STORAGE BATTERY; Thomas A. Edison, Llewellyn Park, West Orange, N. J. App. filed Aug. 10, 1914. Capacity increased.

1,299,736. ELECTRICAL MEASURING INSTRUMENT; John A. Knight, Hamilton, Ont., Can. App. filed June 6, 1916. Highly accurate wattmeter.

1,299,770. IGNITION MECHANISM FOR INTERNAL-COMBUSTION ENGINES; George F. Paldani, Waukegan, Ill. App. filed July 20, 1917.

1,299,813. CONNECTION WITH DRY BATTERIES; Edouard Armelin, South Woodford, Eng. App. filed Sept. 14, 1918. Rigidly connects flashlight cells.

1,299,839. SAFETY LIMIT SWITCH; David R. Knapp, Pottsville, Pa. App. filed Dec. 28, 1917. Automatically stops electric hoist.

1,299,846. MOLDED ELECTRIC CONDUCTOR AND PROCESS OF MAKING THE SAME; James P. A. McCoy, Wilkinsburg, Pa. App. filed Oct. 9, 1915.

1,299,891. KNIFE-BLADE SWITCH; Frederick B. Adams, St. Louis, Mo. App. filed April 29, 1918. Handle attached to tapped socket in blade.

1,299,908. BATTERY HAND LAMP; Charles F. Burgess, Madison, Wis. App. filed March 1, 1916. Protects the lamp from fracture because of too much pressure on its base.

1,299,909. BATTERY HAND LAMP; Charles F. Burgess, Madison, Wis. App. filed March 1, 1916. Protects lamp against accidental lighting.

1,299,910. BATTERY HAND LAMP; Charles F. Burgess, Madison, Wis. App. filed March 24, 1917. Accidental lighting avoided.

1,299,911. BATTFRY HAND LAMP; Charles F. Burgess, Madison, Wis. App. filed March 24, 1917.

1,299,924. MOTOR-CONTROL SYSTEM; John Eaton, Schenectady, N. Y. App. filed April 23, 1915. Plainly marked portable controller for planers to be carried in hand.

1,299,926. COMBINED ELECTRIC PLUG AND SWITCH; David M. Edwards, London, Eng. App. filed Sept. 27, 1917. Switch not "on" until the plug is pushed home nor "off" before the plug is withdrawn.

1,299,931. METAL-HEATING DEVICE; Henry Geisenhoner, Schenectady, N. Y. App. filed Aug. 13, 1918. Heats long objects uniformly.

1,299,947. ELECTROLYSIS OF FUSED ELECTROLYTES; Henry C. M. Ingeberg App. filed Oct. 30, 1917.

1,299,953. STATIONARY INDUCTION APPARATUS; Svend E. Johannesen, Pittsfield, Mass. App. filed May 2, 1917. Core material within windings of transformers is smaller than the cross area of each yoke.

1,299,965. ELECTROMAGNETIC DEVICE; Richard C. Leake, Rochester, N. Y. App. filed March 28, 1916. Rotary electric motor relay acting independently of the armature.

1,299,994. TELEGRAPH INSTRUMENT; Joseph S. Newman, Cleveland, Ohio. App. filed Sept. 15, 1916. Toy.

1,300,022. RELAY FOR TELEPHONE CENTRALS, ETC.; Morten B. Richter, Copenhagen, Denmark. App. filed Feb. 6, 1917.

1,300,062. SUBMARINE SIGNALING DEVICE; George H. Walker, Willow Grove, Pa. App. filed May 2, 1917.

1,300,068. WELDING ELECTRODE; James M. Weed, Schenectady, N. Y. App. filed May 7, 1918. Provided with separable caps.

1,300,074. SYSTEM OF ELECTRICAL DISTRIBUTION; Max A. Whiting, Schenectady, N. Y. App. filed June 6, 1917. Equalizer set for steel mills, etc.

1,300,094. ELECTRICALLY OPERATED VEHICLE BRAKE; Charles Adler, Jr., Baltimore, Md. App. filed June 16, 1917.

1,300,117. METHOD OF AND APPARATUS FOR WELDING; Charles A. Cadwell, Cleveland, Ohio. App. filed June 19, 1915. Current of high voltage utilized.

1,300,126. ELECTRIC SWITCH; William F. Craddick, Salt Lake City, Utah. App. filed Jan. 17, 1918. Multiple resistance connections.

1,300,127. PROTECTIVE DEVICE; Elmer E. F. Creighton, Schenectady, N. Y. App. filed July 21, 1916. Needle-point discharge gap.

1,300,150. AUTOMOBILE-THEFT PREVENTER; St. George Evans and Edward B. Birkenbeuel, Portland, Ore. App. filed March 5, 1918.

1,300,156. RADIOTELEGRAPHY; Leonard F. Fuller, San Francisco, Cal. App. filed March 27, 1916. Means for producing signals.

1,300,157. RADIOTELEGRAPHY; Leonard F. Fuller, San Francisco, Cal. App. filed March 27, 1916. Signaling system for high-powered transmission stations.

1,300,172. RADIATOR; William R. Jones, Summitville, Ind. App. filed June 21, 1918. Moistened air driven over heating coils.

1,300,176. ELECTRIC WATT-HOUR METER; Otto A. Knopp, Oakland, Cal. App. filed Nov. 20, 1916. No under-registration on overloads.

1,300,191. RECORDING APPARATUS; George D. Pogue, St. Louis, Mo. App. filed Nov. 7, 1917. Maximum-demand meter.

1,300,213. JUNCTION BOX FOR CABLE SLICES; Harry G. Freeman, Atlantic City, N. J. App. filed Nov. 10, 1916. Simple connection.

1,300,215. THERMO-ELECTRIC REGULATOR; William G. Hartwig, Chicago, Ill. App. filed July 16, 1917. For street cars.

(Issued April 15, 1919)

1,300,238. MOTOR-CONTROL SYSTEM; Howard L. Beach, Edgewood Park, Pa. App. filed Feb. 3, 1915. Patented April 15, 1919. Operated at uniform speeds under varying loads.

1,300,239. COMMUTATOR BRUSH; Charles B. Berst, Pittsburgh, Pa. App. filed March 25, 1916. For electrical measuring instruments.

1,300,242. SERIES-TYPE DISTRIBUTING SYSTEM; Howard D. Braley, Pittsburgh, Pa. App. filed July 28, 1917. Load circuits maintained at low voltage.

1,300,243. DYNAMO-ELECTRIC MACHINE; Aubrey L. Broomall, Wilkinsburg, Pa. App. filed Feb. 3, 1916. Prevents foreign matter from going through ventilators.

1,300,249. FUSE FOR HIGH-TENSION ELECTRICAL CIRCUITS; Leslie N. Crichton, Salt Lake City, Utah. App. filed Jan. 25, 1913. Outdoor expulsion type.

1,300,251. VAPOR CONVERTER; David C. Davis, Wilkinsburg, Pa. App. filed June 16, 1916. Prevents short-circuiting and reverse arcing.

1,300,265. TUBULAR ELECTRICAL CONDUCTOR; William Handley, Providence, R. I. App. filed Aug. 1, 1916. Seamless woven tube with contained return conductor.

1,300,270. ELECTRIC PLUG RECEPTACLE; William Ile, Toronto, Ont., Can. App. filed Feb. 19, 1917. Rigid double-outlet device.

1,300,277. ELECTRIC RECIPROCATING DEVICE; Greenhow Johnston, Richmond, Va. App. filed April 16, 1917. Readily controlled.

1,300,283. MEASURING INSTRUMENT; Paul M. Lincoln, Pittsburgh, Pa. App. filed April 5, 1917. Maximum-demand meter.

1,300,286. ELECTRICAL FITTING CONNECTION; John A. McKay, Toronto, Ont., Can. App. filed July 1, 1918. May be wired separately.

1,300,293. SYSTEM OF CONTROL; Laurence M. Perkins, Wilkinsburg, Pa. App. filed April 4, 1916. Generated current inherently maintained.

1,300,296. METHOD OF PRODUCING IRON SHEETS BY ELECTRICAL DEPOSITION; Joseph H. Procter, Wilkinsburg, Pa. App. filed Sept. 7, 1917.

1,300,300. SYSTEM OF CONTROL; Karl A. Simmon, Edgewood Park, Pa. App. filed March 4, 1916. Disconnects motor from line automatically.

1,300,303. TROLLEY WHEEL; Antoni Tomaszak, Cohoes, N. Y. App. filed Oct. 20, 1917.

1,300,308. ELECTRICAL CONVERTER; Miles Walker, Manchester, Eng. App. filed Dec. 23, 1916. For polyphase to single-phase current.